159

Food Manufacture

Incorporating Canning, Packing, and Preserving

Vol. VII. **June, 1932** **No. 6**

Empire Food Laws.

LAST MONTH we made a point of the fact that trade in foodstuffs among Empire countries is being hindered by the variable nature of the regulations in force. If it is agreed that inter-Empire trade should be facilitated in every possible way, then it is clear that this question of codifying food laws to bring them into closer agreement is one which demands the serious attention of every manufacturer of food products through the Empire.

How is it to be done? In its entirety the task is tremendous and seems wellnigh hopeless—so discordant, complicated, and confusing is the tangle of laws and regulations which govern the interchange of foodstuffs and their sale in the various countries. Our personal view of the matter is that, in spite of the magnitude of the task, it is one which is capable of gradual approach, that it is essentially a problem of readjustment in easy stages, and that the vital point consists in making a start immediately with the object of smoothing out the more obvious discrepancies.

The next question is, *Who is going to tackle the job and, above all, who is going to take the initiative?* Clearly the answer to this is, the food manufacturers themselves. Through the medium of this journal we have urged that food manufacturers in Empire countries should give their immediate attention to the removal of a specific hindrance to trade development, and we have even gone so far as to bring the matter to official notice, but the next move rests with the manufacturers themselves; it is for them to formulate their case and their proposals.

Our initial efforts to bring to the notice of official circles the desire that exists for simplified regulations should be backed up by the industry. No Government department can be expected to take prime action. That some measure of notice is, however, actually being taken of the matter is evidenced by the request we have received from Mr. J. H. Thomas, the Dominions Secretary and one of the English delegates to Ottawa, for a statement of existing conditions and their resulting inconvenience to Empire trade development.

Porosity of Tinplate.

A paper on the determination of the porosity of tin coatings on steel, which was read at the annual meeting of the Iron and Steel Institute on May 5 and 6, gave an opportunity for the Welsh tinplate manufacturers to claim that the hot dipping process as practised in their works precludes any possibility of the tin not completely covering the steel, as distinct from porosity, this particular trouble being alleged to exist in the case of American tinplate.

Canning in India.

There is evidence of greatly increasing interest in fruit canning in India and adjacent countries. In Baluchistan we are informed that a canning research station on the lines of Campden is contemplated.

Noted Cereal Chemist.

Cereal chemistry owes more to Dr. C. H. Bailey of Minnesota University than to any other single research worker. It is therefore gratifying to learn that a few days ago he received the Osborne gold medal of the American Association of Cereal Chemists "for distinguished contributions in cereal chemistry."

Dr. Bailey was born in Minneapolis in 1887. Since 1911 he has been associated with the Division of Agricultural Biochemistry at the University of Minnesota, where he is now professor. For three years he served as Director of the Minnesota State Experimental Flour Mill, which is claimed to be the largest

and most complete experimental flour mill in the world. He organised and served as Director of the Research Laboratories of the Biscuit and Cracker Manufacturers' Association of America, and he has acted as Administrator of the Bakery Division of the U.S. (Minnesota) Food Administration. Dr. Bailey's activities as an officer of the American Society of Milling and Baking Technology, which in 1923 was merged with the American Association of Cereal Chemists, and as Editor-in-Chief of *Cereal Chemistry*, are well known. He is author of "The Chemistry of Wheat Flour" and of more than a hundred bulletins and papers published in scientific journals.

We can well understand the pride taken by the American Association of Cereal Chemists in making such a justifiable award of the Osborne medal to one of its own members.

Quality.

Mr. Mason, chief chemist of Messrs. J. Mackintosh and Sons, Ltd., discussing the consumer's ideas of quality, has adduced evidence from sales statistics and the results of practical psychological experiments to prove that the public could, and did, distinguish small differences in the quality of food products. For example, a minute variation in the flavour of a product undoubtedly had disastrous results on the sales, which reverted to normal when the alteration was corrected. The market price of different grades of peppermint oil was found to be closely proportional to the marks scored by a number of samples submitted to a group of reliable tasters. Similar experiments with chocolates, the fineness of grinding of which had been determined microscopically, showed that a group of tasters had no difficulty in confirming the results so obtained, since the relationship between the two methods of determination was represented by a perfectly uniform curve.

Training in Food Manufacture.

Evidently the U.S. are not much better off than ourselves as regards facilities for the obtaining of training in the principles of food manufacture. At the last meeting of the American Chemical Society, Mr. C. R. Fellers pointed out that although there are sixty or more universities and colleges training young men and women for the dairy products industries, there are only three or four offering training in the larger field of endeavour. As a result, states Mr. Fellers, the canning industry must, in general, recruit its personnel from other fields, and the same is true of the dehydration, frozen food, fermentation, and other industries. Practically the only training now given in foods is in Departments of Home Economics.

Gnillim.

Milling is in real danger of being inverted. A recent issue of *New Health* had an article on the process, and this is the description of the flow. Wheat "fanned to free it from all dust and chaff, must first be washed," the dirt, "oozing from the perforated cylinders through which the grains are forced by a powerful water spiral"; then "passage through a whizzer" deprives it of "all its moisture," whence the kernels fall "into the divided hoppers on the floor below." There "dividers pick out with unerring accuracy all oats, barley, and cockle seeds"; "separation of the germ" follows, "after which the wheat is finely ground."

For the benefit of our readers who are not millers, or even sugar-boilers, we might liken this flow to the following description of a day in a business man's life. "Got into bed; put on pyjamas and had a bath. Went to church and heard Primo Carnera sing. Had lunch and opened mail. After breakfast went for a couple of hours to Lord's on way home. Put on dinner jacket, and so to bed."

We imagine that such a person would describe himself as an "invert." The word has an ugly sound, and, frankly, we should try to avoid him.

The Fat of the Pig.

Recently we notice that Bhattacharya and Hilditch have been determining the component fatty acids of the kidney fats and the outer and inner layers of the back fats from pigs fed on a basic diet alone, or supplemented with 3 per cent. of shea butter (a solid fat) or arachis oil (peanut oil, a liquid fat). Their results indicate that the body fats from animals whose feed included the relatively saturated shea butter were not greatly different from those of the control fed animals, but the addition of peanut oil led definitely to an increase of unsaturation in the stored fat.

On the whole, the results prove that much of the normal depot fat of the pig must be derived by synthesis within the animal from the carbohydrate or other non-fatty part of the feed rather than by direct assimilation of fat. This deduction appears just as important as the more obvious one that with an excessive fatty diet deficient in carbohydrates the pig is capable of utilising directly much of the ingested fats for storage.

Hydrogen.

Although hydrogen is the simplest atom and the lightest gas, and has been known since Robert Boyle obtained his "ferrous gas," it plays a most important part in our modern civilisation. Dr. E. F. Armstrong, in a lecture to the Royal Society of Arts, recently pointed out some of its industrial applica-

tions, including the hardening of fats, the hydrogenation of organic substances generally, the conversion of nitrogen to ammonia, and the hydrogenation of mineral oil and coal. The discovery of Sabatier that oleic acid could be converted to stearic acid was the beginning of fat hardenings. Nowadays an oil can be given any desired treatment involving only a few degrees loss in iodine value or complete change to a saturated fat. The hardening industry has served to maintain a balance between the cost of hard and soft fats, and one of the results of hardening in America —so Dr. Armstrong informed us—has been considerable increase per head, stated as 10 lb., in the consumption of vegetable oils. This has been commented upon as one of the most striking changes in food consumption that has taken place during the last thirty years.

A True Story.

One day a member of the canning fraternity was having lunch with a miller who was very proud of his patent whites. Ordering lunch the miller said, "Is the asparagus out of a tin? No; then I'll have some." Meanwhile his friend had helped himself to a large hunk of very brown wholemeal bread which he was chewing thoughtfully!

Dried Peas.

The investigations of W. M. Clifford in a recent number of the *Biochemical Journal* on the changes which occur in the soaking of dried peas are of interest. The common treatment of dried peas when used as human food is prolonged soaking so that they may imbibe water, and then boiling. It has been suggested that this procedure causes a loss of protein, mineral matter, and carbohydrates, and thus brings about a drop in the food value of the peas. Clifford found that dried peas on soaking in water for 18 to 24 hours lose 0·1 to 0·15 per cent. glucose. This loss is unaltered by the addition of alkalis and is markedly increased if acids are present, more so with organic than inorganic acids. The rate of cooking peas is unaltered by previously soaking them in acids, alkalis, or salts, hence so far as carbohydrate loss is concerned it does not matter whether peas are soaked in hard or soft water. The addition of the customary pinch of bicarbonate of soda does not alter the loss of glucose or accelerate the cooking—it merely produces the bright green colour.

"Cracklings!"

"Isn't a great deal of life a ludicrous as well as a serious affair?" asks Eustace Miles. We agree; life is really very funny and provides much food for amusement. Thus, after digesting the above remark, we turn a page or two and find that a contributor to food wisdom goes back twenty-three centuries to quote Hippocrates on the subject of fine flour, coarse flour, or wholemeal flour. It really is a surprising thing that after all those years anybody eats white bread at all, but millions do and thrive on it.

Sir Arbuthnot Lane states that the diseases of civilisation are due to the habits of civilisation, and again we agree, but the habit of eating refined foods is not the only habit of civilisation that counts. Civilisation has provided motor-cars, buses, and tubes and so is making people forget how to walk. It has provided cinemas and potted information bureaus which are making people forget how to think and read, and giving them that mental lethargy which is the first step to physical indigestion.

The editor of a homœopathic journal states that liver as a food is discarded. He cannot have read either the MANUFACTURING CHEMIST or FOOD MANUFACTURE, as there we have made frequent references to the increasing use of liver. In fact, far from being discarded, so much liver is being used in present-day therapy that it is almost impossible for the ordinary housewife to buy it, and the price is high. Again he says "tinned meats, embalmed meats are almost valueless"; still the army managed to get along all right with bully beef.

There are not many philosophers who can rival Eustace Miles in backing up theory with so many practical illustrations.

The Campden Report.

We were glad to receive the annual report (1930-1931) of the Fruit and Vegetable Preservation Research Station at Campden, Gloucestershire. No doubt every canner will feel the same way, as this report contains a large amount of useful information. Following several pages devoted to a general account of the work and growth of the Station is a report by Hirst and Adam of tests carried out on canning a large variety of strawberries. It is shown that the qualities most to be desired in varieties of strawberries for canning are brightness and uniformity of colour, evenness in size and shape, firmness of texture, ease of plugging, and richness of flavour.

Then follow reports of tests on the canning of cherries, cultivated blackberries, raspberries, black currants, and plums.

The rest of the report is given over to a description of the results of canning tests on varieties of peas, stringless beans, broad beans, beetroots, carrots, cauliflower, celery, leeks, onions, new potatoes, spinach, sprouts, and turnips.

Again, F. Hirst and W. B. Adam are to be congratulated on the valuable services they have rendered to the English canning industry. One of the most striking features of the rapid growth of the Research Station is brought out by the table given on

page 13 of the report, showing the number of visitors received each month. In October, November, and December, 1930, there were 3, 7, and 2 respectively, while in June, July, and August, 1931, there were 36, 122, and 64 respectively.

Canned Wheat.

In March we wrote, "We have come across many varieties of tinned foods, but we must confess that canned wheat was not among them." That only proves our ignorance, for an American correspondent writes, "When first I heard of canned wheat it was back in 1919 and the idea struck me quite cold. . . . We used three cans at our home and I will say, for your benefit, that the product was excellent, provided that one has plenty of cream and sugar to add to it." At the same time, it does not appear to have become a very popular product, as one gathers that there is probably only one manufacturer of canned whole grain wheat in the United States.

National Mark Flour.

Those who were responsible for the introduction of the National Mark for flour are just beginning to realise some of the pitfalls and quagmires which beset the path of the champion of all-English flour.

It was interesting to read Dr. Salter's remarks on moving the rejection of the Wheat Bill on its second reading. He told us that about two years ago the Kitchen Committee of the House decided that all bread delivered for use in the House of Commons should be made of National Mark flour, wholly home grown, and orders were duly despatched to the contractors to supply only bread which was made exclusively from British flour. The bread supplied was so horrible and the complaints were so numerous that the Kitchen Committee had to countermand the order. Dr. Salter maintained that the Members of the House found out by experience the poor quality of all English flour, and hence the supply of such was promptly countermanded.

Our only remark on this matter is that it does seem curious that one department of the Government should spend public money on advertising all English flour and try to persuade other people to eat National Mark bread which the members of Parliament won't eat themselves! However, we do not pretend to be sufficiently intelligent to appreciate the finer points of political subtleties. Nevertheless, a correspondent asks: "How many of those custodians of our destinies who voted for the Wheat Bill (or against it for that matter) know anything about gluten, wheat blending, or anything pertaining to milling?" Again, our intelligence fails to respond. We should have imagined that these matters are best dealt with by experts who know and understand what they are talking about, not by people who dash into a lobby to vote when the bell rings.

Dried Fruits.

At the same meeting, Nichols and Cruess discussed the present status of sulphur dioxide as a dried fruit preservative. They asserted that no harmful effects have been shown to result from the sulphurous acid in dried fruits, even when eaten in excessive amounts, and no satisfactory substitute has been found for use in fruit drying. The use of sulphurous acid greatly improves the appearance of the product and prolongs its usefulness. Moreover, it has recently been shown that sulphurous acid is essential to the preservation of the vitamins A and C, of which several of the fruits commonly dried are good sources. From this point of view a minimum requirement rather than a maximum tolerance of sulphurous acid seems preferable.

Flour Adulteration.

Frequently, especially on the Continent, wheat flour is adulterated by the addition of rye or barley flour. For the detection of this, accurate microscopic examination is necessary, and except in the hands of experienced microscopists the test may fail. A new and simple method has recently been described by Rudolph and Barsch (*Chem. Ztg.*, 1931, vol. 55, p. 995). Rye and wheat flours are distinguished from each other by stirring about 5 grm. of the material with sufficient hydrochloric acid (s.g., 1·124) to make a tough, pasty mass. When treated thus rye meal soon assumes a red colour which gradually increases in depth, whereas wheat flour shows no change. The presence of 10 per cent. of rye flour in wheat flour is detectable in this way.

The presence of barley meal in rye or wheat flour can also be simply detected. Five grams of the flour are digested with 50 c.c. cold water and filtered. Ten c.c. of the filtrate are treated with 2 c.c. hydrochloric acid, which gives a pronounced turbidity and on heating a flocculent precipitate with either rye or wheat flour extract; with barley there is no turbidity. Five c.c. of the acid wheat or rye extract are treated with 10 c.c. 96 per cent. alcohol. The barley extract immediately turns turbid and later gives a flocculent deposit, while rye or wheat develops at the most a very slight opalescence. Aqueous barley meal extract is coloured intensely yellow by 25 per cent. ammonia. Barley meal is turned brown by 25 per cent. ammonia, wheat flour is unaffected, and rye is turned a greenish-yellow colour. If the flours are stirred with ethyl acetate instead of ammonia solution, barley meal becomes brown or brownish-yellow and wheat or rye pale green.

The Manufacture of Pure Malt Vinegar » »

By W. Warren, B.Sc., F.I.C., and
T. McLachlan, A.C.G.F.C., F.I.C.

The first part of a comprehensive account of the manufacture, properties, uses, etc., of pure malt vinegar.

PART I

IT MAY be as well to preface this description of the manufacture of pure malt vinegar by stating that the words "pure malt vinegar" have been chosen advisedly. At one time there was as much confusion in the various terms applied to vinegar as there is at the present time, and as a result the Association of Vinegar Brewers appealed to the Local Government Board in 1911 for a legal definition of malt vinegar. The Board replied that it had no power to comply with this request, but suggested that the following definitions might be acceptable to all parties:

General Standard for Vinegar.—Vinegar is a liquid derived wholly from alcoholic and acetous fermentations; it shall not contain less than 4 grammes of acetic acid (CH_3COOH) in 100 cubic centimetres of vinegar; it shall not contain arsenic in amounts exceeding 0·0143 milligramme per 100 cubic centimetres of vinegar, nor any sulphuric or other mineral acid, lead or copper, nor shall it contain any foreign substance or colouring matter except caramel.

Malt Vinegar is derived wholly from malted barley or wholly from cereals, the starch of which has been saccharified by the diastase of malt.

Artificial Vinegar.—Artificial vinegar is any vinegar or substitute containing or derived from any preparation containing any added acetic acid which is not wholly the product of alcoholic and subsequent acetous fermentation, etc.

It is the opinion of the authors that this definition, although accepted by many, is not satisfactory; no one would expect "malt extract" to be the substance derived wholly from malted barley or wholly from cereals, the starch of which has been saccharified by the diastase of malt; in fact, the Report of the Pharmacy Sub-Committee of the Pharmacopœia Commission states definitely that "Extract of malt is prepared from sound, malted grain of barley, *Hordeum distichon*, Linn., by infusion with water at a suitable temperature, etc."

It would appear that the result of this definition is to make the position worse now than it was before 1911, since it is now frequently impossible to state by what method vinegar has been prepared. The result of this is, to the authors' knowledge, that attempts have been made to pass off vinegar containing added artificial acetic acid as genuine pure malt vinegar; ammonium sulphate and phosphate have been added to simulate the nitrogenous constituents of grain, although, when converter sugar prepared from maize grits has been employed, this procedure is unnecessary, and is, moreover, easily detected.

While rapid strides have taken place in the preparation of yeast during the last few years, little advance has been made in the brewing of vinegar. On the Continent it has now become customary to utilise stoneware acetifiers of small capacity, but wooden vessels, such as are described in this article, are the general rule in this country, with the notable exception of a modern brewery at Hull, equipped and run by the Distillers Company for the manufacture of "natural fermentation vinegar."

Owing also to the tendency of vinegar brewers in this country to keep their processes secret, there has grown up a considerable confusion of terms; some breweries use the terms "gyle," "wash," and "wort" almost indiscriminately, but an attempt is made in this paper to follow beer brewing practice by calling all unfermented liquors worts.

Processes Involved.

In the brewing of malt vinegar three distinct processes are involved: (1) Mashing, or the extraction of malt with water, during which process starch is converted to sugars and dextrin, and proteins and salts are rendered soluble; (2) fermentation, or the conversion of sugars to alcohol and carbon dioxide; (3) acetification, or the oxidation of alcohol to acetic acid.

It is the object of the brewer to obtain the required strength of vinegar as economically as possible and, with this object in view, each stage of manufacture must be carefully watched.

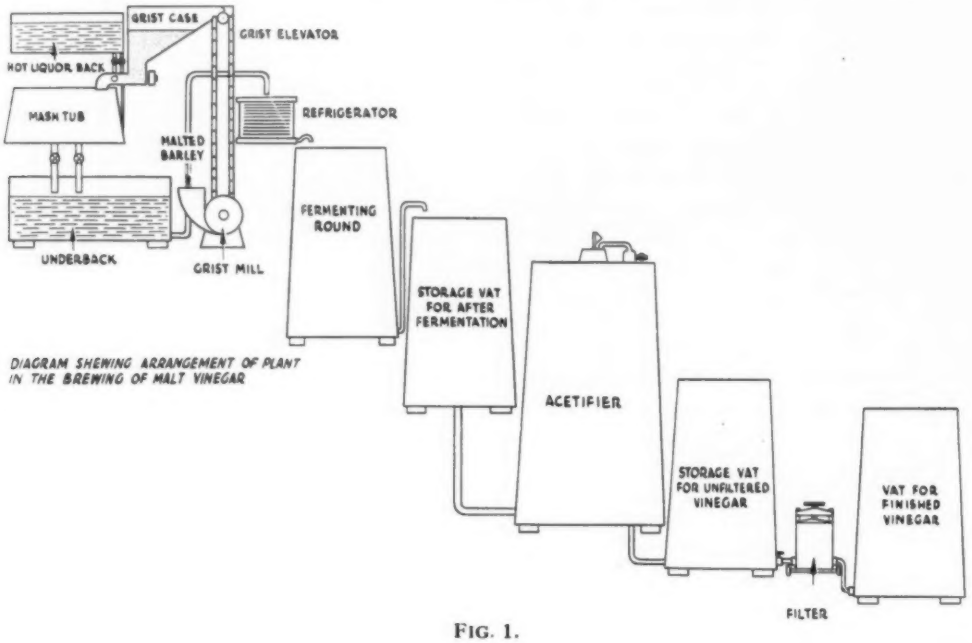


FIG. 1.

Preparation of the Mash.

The raw material, malt, is sometimes brought to the brewery already ground, but as malt deteriorates rapidly once it has been ground, it is more usual to grind it immediately before use. A brewery should be fitted up so that all stages will work as far as possible on the gravity feed principle (see Fig. 1) and, to this end, the grist mill is best placed on the top floor above the mash tun.

The grain is first sieved to remove foreign material, stones and foreign seed, and fed into the mill, where it is either crushed or ground before passing on to a conical wooden container called the grist case. Situated on the same floor as the mill is a large tank, known as the hot liquor back; this is fitted with steam pipes, so that water of any desired temperature may be supplied to the mash tun. Immediately above the mash tun is a mixer or mashing machine, in which the grist and water are intimately mixed in the requisite proportions, and the goods enter the tun in a more or less uniform condition. Forty-five gallons of water are allowed for every quarter of malt and a charge of 10 quarters can be fed into the tun in about 15 to 20 minutes.

The mash tun consists of a large wooden vat fitted with a perforated false bottom and with metal rakes, which travel round on a vertical spindle and whose object it is to keep the goods in motion, when required, during the process of mashing. A sparge with revolving arms is placed near the top of the tun, and two or more large diameter pipes in the bottom to draw off the wort after mashing. Between the false bottom and the real base of the mash tun is a perforated spiral coil, by which water or steam may be underlet in order to dilute the liquor or raise the temperature of the goods. A removable wooden lid closes the tun during mashing. At the commencement of the mash the rakes are set in motion and the goods enter at a temperature of 130° F. After standing for half an hour, a further quantity of water, 100 gallons per quarter and at a temperature of 175° F., is underlet into the tun, bringing the final temperature to 144° F. The goods are raked for 15 minutes and allowed to stand for 2 hours. The wort is drawn off and flows into a rectangular wooden tank, known as the underback, from which it is pumped over a vertical refrigerator, cooled to 65° to 75° F., according to the temperature of subsequent fermentation, and run into the fermenting round. The object of the rapid cooling is to prevent the souring of the wort and the formation of lactic and butyric acids. The grains in the mash tun are mashed a second time at 152° F., 45 gallons of water being allowed for each original quarter of malt. The wort is run off and sparging commenced immediately, 9 gallons of water at 200° F. being allowed for each quarter of malt.

Alternatively, the mashing process may be carried out directly at a temperature of 147° F., in which case the full quantity of water is added at first and sparging is begun immediately the wort is run off. The gravity of the wort must be watched carefully, as the strength of the final vinegar will depend on this; a wort prepared as described will have a gravity of about 1·055 to 1·056, and on fermentation a gyle containing about 6·0 per cent. of alcohol should be obtained, the gravity meanwhile dropping to 1·000.

In the preparation of vinegar from malt only a soft full-bodied malt is employed, possessing a low diastatic activity (about 30° Lintner), but for the hydrolysis of added cereal a hard steely malt with a high diastatic activity is used. Various methods are

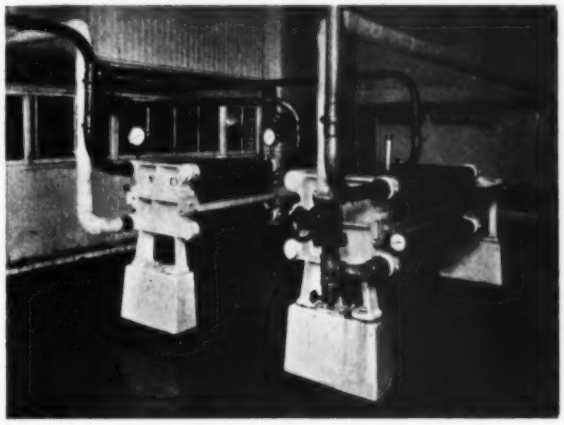


FIG. 2.—"Paraflow" Wort Coolers.
(Courtesy of the Aluminium Plant and Vessel Co., Ltd.)

employed for the preparation of such a wort, according to whether barley, rice, or maize grits are added, but it is best to gelatinise the added starch by means of steam before running it into the mash tun together with sufficient cold water to bring the final temperature of the mash to about 140° to 147° F. It is customary to add oats to the mash tun when using a mixed mash, as these assist in the running off of the wort. Typical proportions for a mixed mash are malt 27·5 quarters, barley 55 quarters, and oats 17·5 quarters. Solid glucose and converter starch are added by some manufacturers, but vinegars prepared by this method should not be described as malt vinegars, and their preparation will not be described.

Alcoholic Fermentation.

The wort in the fermenting round is now pitched with yeast to convert fermentable sugars into alcohol and carbon dioxide. Fresh distillers' yeast is the most suitable variety to use, and 28 lb. are required for the complete fermentation of 2,000 gallons of wort. The yeast is mixed into a thin paste with a gallon or two of the wort and allowed to stand for about 20 minutes, during which time a good head is formed, and at this stage the mixture is transferred to the wort in the fermenting round, fermentation being allowed to proceed for about seven days, the actual time required being longer or shorter according to the temperature of fermentation. The temperature of pitching and fermentation varies according to breweries and the type of yeast employed; old-fashioned brewers prefer to pitch at about 65° F. and ferment below 78° F., while many of the more advanced ones pitch at 75° F. and allow the temperature to rise as high as 95° F.

After fermentation the gyle is racked off into large storage vats and allowed to stand for at least fourteen days; many brewers prefer to keep this alcoholic wash for several months before acetification. During storage a preliminary acetification takes place, as much as 2 per cent. of acetic acid being formed, and, due to the presence of more alcohol at this period, a higher percentage of esterification takes place, with a consequent improvement in the flavour of the finished vinegar. This period of storage also assists in the clarification of the gyle and removes much finely suspended matter, making the final filtration an easier process.

After fermentation the alcoholic wash should be tested chemically, the alcoholic strength and the

FIG. 3.—Fermenting Vessel with Rouser.
(Courtesy of the Aluminium Plant and Vessel Co., Ltd.)

gravity being determined. The alcohol content in our case will be about 6·5 per cent. and the gravity about 1·000.

The Acetifier.

Before discussing the process of acetification it may be of interest to give a short description of the construction and packing of a small acetifier. Reference to the accompanying diagram (see Fig. 4) will make this clearer. The acetifier consists essentially of a tall conical-shaped wooden vat of about 8,000 gallons capacity, this being large enough to take a charge of 2,000 gallons of gyle. It is usual to erect the acetifier on concrete or brick pillars, so that the bottom is raised about 2 feet from the ground. The staves are made as narrow as possible, since the temperature during acetification will rise above 100° F., and consequently the narrower the staves the less the distortion due to heat variation. A stout wooden pillar is fixed to the floor inside the vat, and to this are attached two frameworks of spider-web structure to serve as supports for the birch twigs.

The acetifier is so arranged that half its volume is filled with birch twigs, the lower half being left for vinegar and air. The packing of the acetifier requires much practise and care, since the successful working depends to a great extent upon the easy passage of air and vinegar over as large a surface of twigs as possible. Birch twigs are usually employed as the medium to which the acetic acid bacteria may attach themselves, though wood shavings, basket-work, and even coke have been employed for the purpose. The twigs arrive at the brewery tied up into small neat bundles, and these are thoroughly cleansed by immersion in very hot water, after which they are drained and dried. The bundles are packed on to the wooden frameworks one at a time, as shown in the diagram, the first layer lying parallel to the radial struts, the second layer at right angles to the first, and so on alternately to the top of the acetifier. Care must be exercised that those bundles nearest to the central support are not packed too tightly together and that those on the outside are sufficiently close. By this means a correct distribution of air currents passing upwards from below is assured, otherwise the greater part would pass through the outside layers and little or none through the central portion. For the supply of air to the acetifier 1-inch holes are sometimes bored in the side of the vat a little below the lower layer of twigs, and these may be opened or shut by means of tightly fitting plugs. A better method, however, is to run two large ebonite pipes through the base of the acetifier, adjacent to the central pillar, as illustrated in the diagram. The tops of these pipes are covered with a cowl to prevent vinegar falling into them, and they are continued on the outside of the acetifier by short pieces of metal piping. A short distance from the end of each pipe a narrow slot is made halfway across, and, to regulate the air supply, pieces of tinplate bored with holes of different sizes may be dropped into these. The sparge box and arms, constructed of ebonite, are fitted at the top of the central pillar in such a way that the whole may rotate freely about a vertical axis. The top of the acetifier is wooden and is perforated with about forty holes 1 inch in diameter. These holes

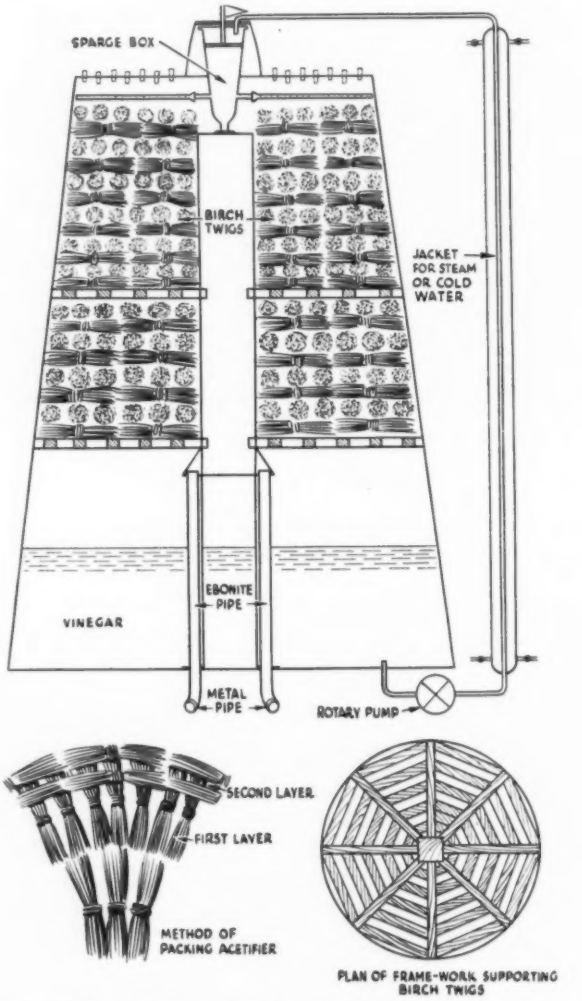


FIG. 4.—Diagram Illustrating Construction and Packing of an Acetifier.

are provided with tightly fitting wooden pegs, which may be removed at will in order to adjust the amount of the air supply. Continuous circulation of the alcoholic wash is ensured by an external pipe from the bottom of the acetifier to the top of the sparge box, the flow being maintained by a small rotary pump, driven by a 1 h.p. motor.

Acetification.

The most important and difficult part of the process is the acetification of the gyle, and before this can take place the birch twigs have to be inoculated with a culture of the acetifying organism, known as *mycoderma aceti*. The most satisfactory method of doing this is to obtain about 50 gallons of freshly brewed, unfiltered vinegar from another brewery and to pass this over the twigs, About 2,000 gallons of wash are now run into the base of the acetifier and the pump set in motion. At the same time steam is passed through the jacket surrounding the vertical pipe in order to raise the temperature slowly. The liquid leaving the sparge box runs in fine streams

from the holes in the arms and the force exerted in the process is sufficient to set the arms in motion and distribute the wash evenly over the whole of the top surface, whence it trickles down through the birch twigs. About half the pegs in the cover of the acetifier are removed and a watch kept on the temperature of the vinegar at the bottom. After a time the temperature rises spontaneously, even though the steam is turned off; it is, however, kept at 94° F. until 2 per cent. of acetic acid is formed, and is allowed to increase slowly until about 110° F. is reached, and this is maintained by a careful adjustment of the air inlets and outlets and by regulating the speed at which the wash passes over the birch twigs. It sometimes occurs that, through faulty regulation of the air supply, the temperature of the wash rises too high; this retards the activity of the bacteria and also causes a loss of the volatile constituents of the vinegar; in such a case cold water is passed through the jacketed pipe and the temperature again reduced to the optimum.

The time taken to convert a charge of alcoholic wash into vinegar is from seven to ten days, and during this period daily samples must be taken and tested for their alcoholic and acetic acid contents. A typical graph of the first run of a recently packed acetifier is shown in Fig. 5. Towards the end of the process greater vigilance is required, because a point is reached when the acetic acid produced is at a maximum, and if the vinegar is still allowed to remain in the acetifier destruction of the acetic acid begins to take place, causing a rapid fall in the acidity. At this stage the vinegar is rapidly transferred to a suitable storage vat, and it will now be found that the alcoholic strength varies from 0·2 to 0·5 per cent. The first run in a newly packed acetifier invariably yields a vinegar slightly low in acid, a deficiency varying from 0·5 to 1·0 per cent., but subsequent runs give products of the maximum strength.

The losses taking place in an acetifier during the oxidation of alcohol into acetic acid are rather heavy; even when worked under ideal conditions about 35 to 40 per cent. of the theoretical amount of acid is lost.

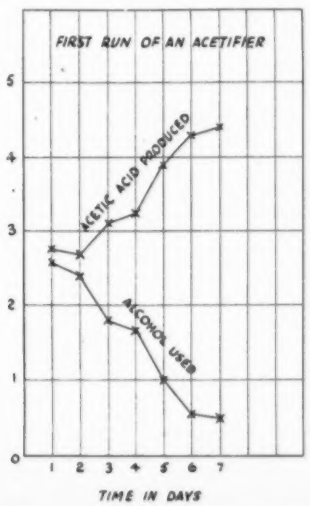


FIG. 5.—Typical Graph of the First Run of a Recently Packed Acetifier.

Thus an alcoholic wash containing 6·5 per cent. of alcohol should theoretically yield a vinegar containing 8·5 per cent. of acid, whereas in actual practice the content will not exceed 5·4 per cent.

After removal of the vinegar from the acetifier, it should be stored for as long a period as possible. During this time the flavour improves and suspended matter deposits at the bottom of the vat, thereby facilitating subsequent filtration.

Filtration.

Many types of filter have been employed for the clarification of vinegar, ranging from barrels containing grape skins to the most modern forms of filter. Until recently, paper pulp has formed a very popular bed through which to pass the vinegar, the usual method being to employ a vat fitted with a false bottom about one third of the way up. This false bottom was pierced with numerous holes and was covered with cloth, on the top of which was run a layer of paper pulp specially prepared at the right consistency in a washing machine. The vinegar to be filtered flowed on to this bed and slowly trickled through into the lower portion, if necessary being returned to the top of the vat again for reclarification or passed through a second filter. The disadvantages of this type were numerous; the preparation of the filter occupied a considerable time, the vinegar did not run clear at first, and, when it did do so, the rate of filtration was slow, while the periodic cleaning was a nuisance. This type of filter has now been replaced in most breweries by more modern ones of the patent type, which possess one or more of the following advantages—size, portability, and last, but not least, better clarification.

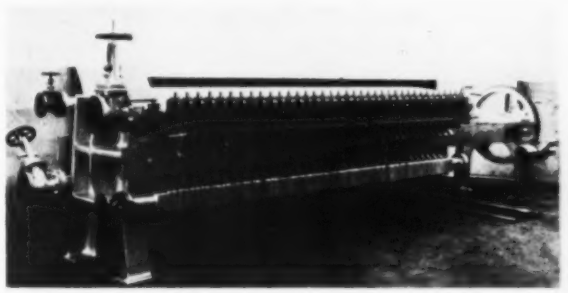


FIG. 6.—A 36-Chamber Jacketed Filter Press provided with Independent and Visible Outlet to each Filter Chamber. The plates and frames may be constructed of various materials according to requirements.

(Courtesy of Robert Kellie and Son., Ltd.)

A suitable type of filter is one in which the arrangement of filter plates permits of a very large surface of filter being exposed, while occupying a comparatively small total volume (see Fig. 7). These filter plates are made up on frames, consisting of a central screen, to which cotton pulp is attached by means of hydraulic pressure, and are laid in the filter alternately with coarse mesh screens, open to the outer surface of the filter, but separated from the central column by means of a small rubber gasket. Thus, there may

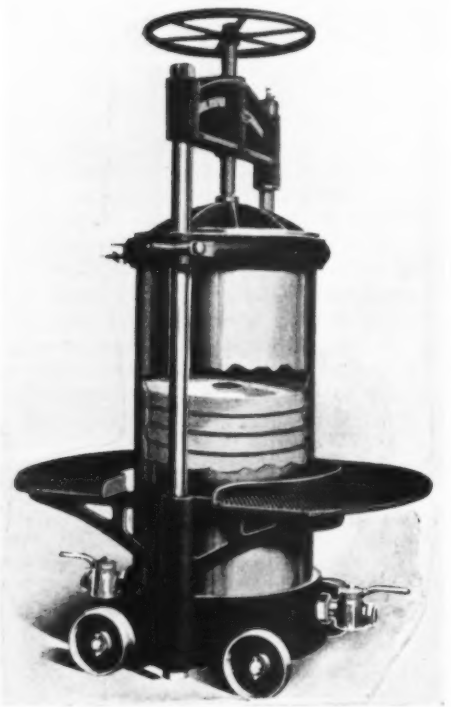


FIG. 7.—A Karl Kiefer Double Plate Filter, showing the arrangement of the Filter Plates.

be forty-four of these plates, each of 24 inches diameter, and between them they expose a total filter surface of 21,000 square inches. The filter plates may be formed at any pressure that may be required, usually at about 35 lb. pressure, and owing to the small spaces between the fibres all bacteria and yeast cells are removed, thus ensuring a sterile filtrate, as well as a candle-bright vinegar, if the filter has been properly prepared. The vinegar enters the filter through a pipe at the bottom, finds its way to the top of the filter in the outer annular space, enters the coarse mesh screens, passes through the pulp, and thence flows into the fine mesh screens, into the central passage, and from there to the outlet of the filter at the bottom. When the filter has been packed, and before being used for the filtration of vinegar, it should be sterilised by live steam; this is done gradually and at low pressure in order not to disturb the filtering medium. Filtration may be carried out at low pressure, or, in order to increase the rate of filtration, pressures up to 80 lb. are quite satisfactory and give a sterile and candle-bright vinegar.

As will be appreciated, the filter will become choked eventually with suspended matter removed from the vinegar, and, to clean it, all that is necessary is to unscrew the top, remove the filter pads by means of a special handle, break up the pulp into a washer, and then reform the plates in a packer.

Instead of using pulp filters, good results are obtained by employing almost any other kind of pressure filter, preferably of the wooden plate and frame type, in conjunction with Celite Filter-Aid applied as an initial coating to the filter cloths and as an addition to the main batch of vinegar. For the pre-coat about 5 lb. of the Filter-Aid for every 100 sq. ft. of filtering area will be required. This forms a thin layer which prevents the meshes of the cloth from becoming clogged and keeps the main filter cake from coming into direct contact with the cloth. The quantity of Filter-Aid mixed with the main batch amounts to about 0·1 to 0·25 per cent. by weight of the vinegar filtered, and this ensures a porous and free-filtering cake. There are several grades of Filter-Aid, and they are milled from pure diatomaceous silica, the individual particles of which are microscopic in size, porous, and inert.

Vinegar, on leaving the filter, possesses a pale straw colour; the reddish-brown colour usually associated with it is due to the addition of caramel. Care must be taken in the selection of a caramel for vinegar colouring, as some caramels do not give an immediate turbidity, but throw down a deposit after standing for a short time. A good quality caramel must, therefore, be specified, so that the brilliancy of the vinegar is not impaired, and about 4 to 7 lb. are added to each 100 gallons, depending on the colour value of the caramel and on the exact tint required. The colour of both the caramel and the finished vinegar should be standardised by means of a tintometer; a good vinegar caramel should have a colour value of approximately 30,000° measured on the Lovibond Tintometer.

Experimental work has been carried out recently on the use of the Sharples Super-Centrifuge in the clarification of vinegar, and although the authors have not had any experience of this centrifuge in the actual manufacture of vinegar, it would appear that this should be a most useful adjunct to a large brewery. A large centrifuge of this type will pass about 300 gallons of vinegar per hour and remove most of the suspended matter, but will not make it candle bright; it will, however, reduce the amount of cleaning required by a pulp filter considerably, and the advisability of its installation would depend almost entirely on the output of the brewery.

(To be continued.)

Manufacture of Sauces

The above article on the Manufacture of Vinegar will be concluded in next month's issue.

The authors are engaged upon an exhaustive article dealing with the Manufacture of Sauces, which will be published in the August issue.

Fumigation with Ethylene Oxide

By T. H. FAIRBROTHER, M.Sc., F.I.C.

One of the most difficult problems faced by almost every branch of the food industry is the elimination and suppression of pests. For this reason alone we are careful to keep readers in touch with all new developments in fumigants and fumigation methods. In the December, 1930, issue the writer dealt with the use of hydrogen cyanide. Since that time much research has been devoted to another fumigant—ethylene oxide—and in the present article the writer summarises such information as has been published on the subject.

THE FIRST published work on the use of ethylene oxide as a fumigant appeared in *Industrial and Engineering Chemistry*, August, 1928, in a paper by Cotton and Roark, of the Bureau of Entomology and Bureau of Chemistry and Soils, Washington. These workers, in the course of an investigation of several aliphatic compounds to determine their value as fumigants, discovered that the vapours of ethylene oxide are highly toxic to insects.

Properties of Ethylene Oxide.

Ethylene oxide is made by the action of caustic potash on ethylene chlorhydrin (CH_2OHCH_2Cl). At ordinary temperatures it is a colourless gas; at low temperatures it condenses to a colourless mobile liquid. Boiling point 10·5° C. Its specific gravity at 4° C. is 0·887. Its formula is $(CH_2)_2O$. It is miscible with water in all proportions and is soluble in the usual organic solvents. It is very reactive, and combines with all compounds having a labile hydrogen, such as water, alcohol, ammonia, and acids. The concentrated vapours are inflammable, but concentrations lethal to insects can be used with safety.

Toxicity.

As regards toxicity, Cotton and Roark state that it is not highly toxic to man, but when inhaled for a long time it produces a cyanosis, which, however, is counteracted by the use of carbon dioxide gas. Interesting work on the toxicity of ethylene oxide is described in the *United States Public Health Reports* (vol. 45, No. 32, August, 1930, p. 1832). The experiments were carried out on guinea-pigs, and in order of occurrence the symptoms produced are nasal irritation, eye irritation, blood-tinged frothy serous exudate from nostrils, unsteadiness on feet and staggering, inability to stand, respiratory disturbances, dysprea and gasping, and death. Most of these symptoms occurred with exposures to concentrations of 8·5 to 0·3 per cent. in volume. Eye and nose irritation were the principal symptoms with exposure to 0·13 and 0·06 per cent., and no distinct symptoms were observed with exposure to 0·025 per cent.

From the standpoint of relative toxicity (concentrations causing acute harm), ethylene oxide is less harmful than hydrogen chloride and sulphur dioxide, more harmful than chloroform and carbon tetrachloride, and similar to ammonia. It does not possess enough odour to give distinct warning of harmful concentrations, but it causes intolerable irritation to the eyes and nose when present in high concentrations, and moderate, though distinct, irritation in comparatively safe concentrations. This irritation can be taken as a warning of a dangerous atmosphere to avoid serious injury.

Original Experimental Work.

In their preliminary experiments, Cotton and Roark used half-litre Erlenmeyer flasks containing 200 grams of wheat and found that 20 milligrams per litre constituted the minimum lethal dose for specimens of the rice weevil under those conditions. Tests on a larger scale were conducted in a 500 cubic foot fumigation vault. Insects in cotton stoppered glass vials were placed in the vault. The fumigant was applied by pouring it into a shallow trough near the top of the vault or by allowing it to escape into the vault from a small cylinder containing the fumigant in liquid form under pressure.

A dosage of 1 lb. per 1,000 cubic feet for 20 hours proved to be 100 per cent. lethal to the clothes moth (*Tineola biselliella*), the carpet beetles (*Attagenus piceus* and *Anthrenus vorax*), the rice weevil (*Sitophilus oryza*), the Indian meal moth (*Plodia interpunctella*), the saw-toothed grain beetle (*Oryzæphilus surinamensis*), the red-legged ham beetle (*Necrobia rufipes*), and the flour beetle (*Tribolium confusum*).

Comparative tests indicate that ethylene oxide is one and a half times as toxic to insects as carbon bisulphide and thirty times as toxic as carbon tetrachloride. Owing to its low boiling point, ethylene oxide is effective at comparatively low temperatures. Apparently the gas has great penetrative powers, and insects buried in overstuffed furniture, sealed in packages of cereals, and buried in jars of rice were killed with ease. At a recent flour mill fumigation with ethylene oxide, at which the writer was present, some heavily infested flour moth webbing was buried in a sack of flour and exposed during the fumigation. There was a complete kill of all stages of the insect and evidently the eggs were killed as well as the adult stages, as no moths developed subsequently from the webbing on exposure to the air.

Effect of the Gas on Foodstuffs.

Much work has been published on the effect of ethylene oxide on foods. Cotton and Roark found that nut kernels and dried fruits, even immediately after being gassed at a concentration of 31·25 grams to the cubic metre, showed no alteration in smell or taste. Hoyt reported that prunes, almonds, and walnut kernels showed no alteration of their usual

Purifier Floor of Flour Mill ready for Fumigation by Gas Cylinders seen on the Right.

Elevator Boots after Fumigation. A Dead Rat, Moth, and Web can be seen.

properties after being gassed with ethylene oxide. He states, however, that the quality of cocoa is affected, and unsweetened chocolate, after the lapse of three days, still retained the smell of the oxide.

Possibly the most comprehensive work on the effect of ethylene oxide on foodstuffs is that of Professor Sudendorf and Dr. Kroeger (*Chemiker Zeitung*, No. 57, 1931). They set out in a very comprehensive manner to determine, from the point of view of the foodstuffs chemist, whether the commercial mixture of ethylene oxide and carbon dioxide was suitable for commercial use as a vermin killer in rooms where foodstuffs are stored. They worked on a large variety of foods—eighty-six different foods being studied. They selected for their laboratory tests concentrations of ethylene oxide which were in some cases double and even tenfold the strength usually prescribed. Their paper contains a table in which their findings are summarised, and those interested in the fumigation of food stores are recommended to study this paper carefully.

They found no trace of exterior alteration in any of the substances treated, not even where the strongest gas concentrations had been used. More particularly in the case of samples of fruit and vegetables, no alteration in colour, no withering, softening, or collapse of the surface was observed. After the lapse of six days the fresh fruit and vegetables showed no more signs of alteration than the control samples. They conclude that as a result of the ship tests, which were based on practical conditions, no perceptible alteration occurred in any of the foodstuffs gassed with ethylene oxide.

After a ventilation period of 24 hours, in no single instance was any taste or smell of ethylene oxide noticed. The same applied to laboratory tests made under the strongest gas concentrations. The foods tested in this work included flour, bread, butter, margarine, lard, cheese, meat, ham, bacon, sausage, eggs, cod, coffee, cocoa, tea, chocolate, sago, rice, sugar, beans, peas, lentils, potatoes, brussels sprouts, turnips, cabbage, oranges, apples, bananas, plums, gooseberries, grapes, apricots, figs, currants, raisins, and prunes. It is difficult to imagine a more varied or comprehensive study.

Dried Fruits.

The use of ethylene oxide as a fumigant for dried fruits has been studied by Thomas of the Australian Commonwealth Research Station, Merbein (*Journal of the Council for Scientific and Industrial Research*, vol. 4, No. 1, February, 1931). His work concerned mainly the destruction of the larvæ of *Plodia interpunctella*. He summarises the advantages of ethylene oxide as follows:

1. The high toxicity at low concentration (2 lb. per 1,000 cubic feet).
2. The absence of fire hazard when used at these concentrations.
3. The low boiling point which renders the gas effective and highly penetrating even at low temperature.
4. Little danger to the operators even if inhaled for a period.
5. No harmful effect upon the foodstuff fumigated.

In his experimental work Thomas collected eggs of the dried fruit pest (*Plodia interpunctella*) and

Interior of Roller Mill after Fumigation, showing Dead Moth.

used them to infect clean sultanas, which were then exposed to the action of ethylene oxide in a bell jar at the rate of 2 lb. per 1,000 cubic feet for periods of from 3 to 24 hours. Examination fifteen days later showed that no eggs hatched in the treated samples, whereas in the controls hatching was normal.

Penetrating Power.

In order to test the penetrating power of ethylene oxide ten lots of twenty-five larvæ were enclosed in a small tin vessel an inch long, with wire gauze ends, wrapped in linen, and placed in the centre of tightly packed sultanas in a container 9 by 3 inches, open at each end. Five lots were treated in February-March and five in August, 1930. Exposures ran from 2 to 24 hours with 90 per cent. kill at 2 hours and 100 per cent. for 3 hours and over. In tests with pupæ none of the fumigated developed, whereas with untreated, 40 per cent. developed into moths.

For a commercial test an airtight steel drum with a capacity of 125 cubic feet was employed. Four 56-lb. boxes of sultanas were selected and in each box three lots of twenty-five larvæ enclosed in the small receptacles mentioned above were buried. The boxes were repressed, nailed down, and placed in the drum. Ethylene oxide at the standard dosage was added, the drum closed down at 4.30 p.m. and opened at 10 a.m. the next day. On opening, 70 per cent. of the larvæ were found to be dead. Curiously enough, the 30 per cent. alive on opening were quite active, but all died within 36 hours. In this experiment the mean temperature was only 50° F., which possibly accounted for the delayed kill. This work seems to establish the fact that ethylene oxide is an effective fumigant against eggs, larvæ, and pupæ of the dried fruit moth.

Effect on Flour Mill Pests.

The effect of ethylene oxide on flour mill pests is well illustrated by a report by Mr. Bako, Director of the Entomological Station, Budapest, on the fumigation of a mill at Tisza. He stated: "After ventilation the situation was as follows: In all parts of the mill and on every story we found a surprising number of dead flour moths, flour beetles, larvæ, and grubs. Not a living beetle was found anywhere, even in the remotest corner of the mill. But the most convincing proof of the effect of the gas I expected to get from the corn beetle specimens which I had placed in air and gas tight cardboard boxes doubly enclosed in pairs from the bottom to the top story. Each of these boxes was sealed up with gummed paper and dextrine. One of these boxes remained in this completely closed up condition, but the two sides of the other one, facing each other, were pierced with small holes by means of a needle, in order to admit the diffused gas." On examination two days after fumigation it was seen that a complete kill of the beetles in the cardboard boxes had been effected. In the controls, shut up in exactly the same way, kept at the Institute, all the beetles were perfectly healthy.

Method of Application.

The fumigation can be carried out during a week end, the fumigating officers taking over the mill on Saturday and handing it back free of gas on the following Monday morning at the usual starting up time. The method is extremely simple. All machines, spouts, elevators, worm boxes, etc., are opened up and the mill windows and doors carefully sealed. The fumigating officers then enter and place two or three gas cylinders in position on each floor. Special nozzles are fitted to the cylinder caps and the gas is released in the form of a fine white spray. The premises are then left under gas for 24 hours. At the end of this period all windows and doors are opened and the cylinders are removed. After a few hours it is safe to enter without a gas mask.

Dust Collector after Fumigation. Dead Weevil are lying on the Floor.

(This and the other photographs by courtesy of the London Fumigation Co.)

The Bacteriology of Common Salt

By WILLIAM CLAYTON, D.Sc., F.I.C.
Chief Chemist and Bacteriologist to Messrs. Crosse and Blackwell, Ltd.

A series of articles reviewing present knowledge in relation to the bacteriological action of salt. Part IV. dealt with the reddening of salted fish. Part VI. will deal with the salting of butter and margarine.

PART V.—THE BRINE FERMENTATION OF VEGETABLES

THE PREPARATION of sauerkraut and of vegetables pickled in vinegar provides a simple but interesting example of selectivity in bacterial action achieved by salt tolerance. Olives in brine come into this category also. The predominating characteristic is fermentation by lactic acid organisms.

Sauerkraut.

This is cabbage which has undergone a lactic fermentation,[1] the thin shreds of the vegetable being mixed with 2·5 per cent. its weight of salt. Pressure is applied to the mixture, and this with the salt leads to juice extraction. Lactic strains of micro-organisms cause a fermentation with vigorous gas production (practically entirely CO_2)[2] and lactic acid, alcohols, and mannitol. The optimum temperature range[3] is 15·5° to 21° C., and the fermentation requires 2 to 3 weeks. Higher temperatures often lead to soft and pink sauerkraut,[4] this being due to a pink yeast.[5]

Considerable discussion has taken place regarding the organisms responsible for the gas production, but the work of Peterson and Fred and their associates points to numerous mannitol-forming bacteria which convert 20 to 25 per cent. of the glucose and other sugars into alcohol and CO_2. These workers found that washing the cabbage before cutting and packing in salt decidedly improved the flavour of the sauerkraut. This is evidently connected with the removal of undesirable bacteria—*e.g.*, butyric fermentation type.

The final acidity of the sauerkraut reaches 1·5 per cent. lactic acid. Since a lactic acid fermentation is involved, due to a favourable salt tolerance condition, it is natural to infer that the use of pure cultures would confer beneficial results. From time to time investigators have suggested this, but an extended research by Pederson[6] has recently shown that the flavour is not improved and the author definitely advises against the use of pure cultures for the present. Pederson made seventy-two experimental batches, inoculating twenty-five with pure cultures of *Streptococcus lactis*, *Leuconostoc mesenterioides*, *Lactobacillus buchneri*, *Lactobacillus pentoaccticus*, *Lactobacillus delbrücki*, *Lactobacillus plantarum*, and *Lactobacillus brassicæ*. Whilst pure cultures of *Streptococcus lactis* improved the quality of the sauerkraut with no change in the nature of the fermentation products, the other strains altered the course of the fermentation and the quantitative relations of the by-products, with consequent undesirable changes in flavour. Curiously enough, the pure culture sauerkrauts were peculiarly susceptible to spoilage by yeasts.

Such results lead the present writer to incline to the view that the desirable fermentation may be due to a symbiotic bacterial action, still an open inquiry. In passing, it may be recalled that a favourite national dish in Russia, "sktshi," is similar to sauerkraut, but the cabbage is fermented in a mixture of vinegar and salt. Presumably the bacterial flora will be different in this case, but no investigation seems to have been published thereon.

Pickles.

The practical preparation of pickles has been previously described in FOOD MANUFACTURE (**2**, 211 (1927); **3**, 415 (1928); **5**, 185 (1930)). Additional information is given by Tanner.[7]

Before vegetables (cucumbers, onions, gherkins, cauliflower, etc.) can be marketed in vinegar as pickles, they must undergo a lactic fermentation in brine. This fermentation contrasts markedly with that of sauerkraut, being much slower and necessitating a much higher salt concentration. The washed vegetables are placed in brine ranging from 10 to 15 per cent. salt, the weaker brine sufficing in colder weather, since the fermentation is influenced by temperature as well as salt content. Lactic acid forms, but the *p*H of the brine is influenced by the juice of the vegetables, which contains as buffers dialysable acid-salt complexes, and to a much smaller degree proteins.[8]

The vegetables, as a result of the bacterial action, change in translucency and become crisp. Fermentation may occupy up to several months, depending on

the temperature, but the vegetables may subsequently be retained almost indefinitely in brine of 15 per cent. strength.

Vegetables carry soil organisms, and although the salt concentration is such that lactic fermentation gains preference, many types of salt-tolerant organisms abound. They do not necessarily take part in the pickle changes. A detailed investigation by Le Fevre and Round[9] isolated twenty-one bacilli from the brine of fermented cucumbers, the medium used being cucumber-juice agar + 10 per cent. salt. The organisms fell into five groups: (1) Non-motile, non-sporing bacilli, average size $0.5 \times 2\mu$; (2) non-motile, non-sporing, Gram negative bacilli, $0.5 \times 4\text{-}6\mu$; (3) Gram positive bacilli with elliptical terminal spores, $0.5 \times 4\mu$; (4) Gram positive, non-sporing bacilli, motile, $0.4 \times 3\mu$; (5) Gram positive, non sporing bacilli, motile, $0.3 \times 2\mu$.

It was remarkable that these organisms were all capable of growing in 25 per cent. salt, and only group (1) could be grown on non-salt media. In all cases growth was slow, even at the optimum temperature of 30° C., and an acidity of *p*H 5 inhibited growth in all but one strain, although all except three grew in salt broth of *p*H higher than 6.

Scum Spoilage.

Frequently a cask of vegetables in brine shows a white wrinkled scum, due to the growth of wild yeasts—*e.g.*, *Mycoderma cucumerina*. Since such yeasts oxidise lactic acid to CO_2, putrefactive spore-forming organisms—*e.g.*, the ubiquitous *B. subtilis* group—have an opportunity to develop and softening of the vegetables occurs. Periodic skimming of the brine serves to minimise this trouble, whilst the scum is totally avoided by covering the brine with a layer of neutral mineral oil.[10] Recent investigation by Rahn of Cornell University shows that the scum may be avoided by daily irradiation of the brine surface by ultra-violet light.

Olives.

A detailed account of the pickling of green olives has recently been given by Creuss.[11] Manzanillo, Mission, Barouni, and Ascalano olives are treated with 1·7 to 2 per cent. lye (NaOH) and Sevillano olives with 1·6 per cent. lye. Penetration of lye at room temperature takes place for 5 to 6 hours to a half to one-third the distance to the pit and removes most of the bitterness of the fruit. Washing follows for 30 hours in water changed frequently, whereby the olives become ready for brine fermentation.

An initial NaCl concentration of 11 per cent. is used for Manzanillo, Mission, and Barouni olives, and 5 per cent. for Sevillano and Ascalano, this being raised in 4 to 5 days to 7 to 8 per cent. Shrinkage is thus avoided. Fermentation is hastened by small amounts of vinegar or lactic acid and by using an active "starter" (pure lactic culture). Addition of dextrose favours the fermentation and leads to higher acid production.

The lactic fermentation being completed, the olives are packed in 7·5 per cent. brine.

Cloudy Olive Brine.

A common detriment to packed olives is cloudy brine, which may arise from at least two sources. The first type is due to wild yeasts, the NaCl concentration causing their deposit as white flakes. Ayers, Barnby, and Voigt[12] have investigated this trouble and shown that hot packing or vacuum sealing with a tight seal will avoid the trouble. Alternatively, they recommend pasteurisation at 60° C. for 10 minutes, when the brine strength is not less than 8 per cent. The addition of olive oil to seal the brine surface is a patented device to the same end.

The same authors examined the second type of clouding, wherein the brine becomes uniformly cloudy and a white sediment appears on the green olives in contact with the wall of the bottle.[13] A bacillus causes this effect, and although its growth could be inhibited in laboratory media containing 9 per cent. NaCl and *p*H 6·6 to 7·0, it is not feasible in the bottled olives on flavour considerations.

The bacillus appears to be a lactic acid organism, and its action is a secondary fermentation due to the original fermentation having been incompleted. It was found that pasteurisation of the pack at 60° C. for 15 minutes destroyed the organism. Alternatively, the olives should be packed in brine of 8 per cent. strength + 0·5 per cent. lactic acid. In this connection, Mullen[14] advocates the filtration and decolorisation of the original brine with its 1 per cent. lactic acid content, and the use of this in the bottles instead of fresh brine.

(Next month Dr. Clayton will discuss the salting of butter and margarine.)

REFERENCES.

[1] Rummel, "Gurken-Konservierung, sowie die Fabrikation von Sauerkraut und a. Salz- und Essigemüse nach d. prakt. Erfahrungen d. Neuzeit" (Brunswick: Serger and Hempel); Le Fevre, U.S. Dept. Agr., *Circ.* **38** (1928); Peterson and co-workers, *Soil Sci.*, **30**, 451-457 (1925); **24**, 299-307 (1927); *Canner*, **61** [iv.], 19-21 (1925); Pederson, N.Y. Agr. Expt. Sta., *Bull.* **595**, 3-23 (1931).
[2] Preuss, Peterson, and Fred, *Ind. Eng. Chem.*, **20**, 1187-1190 (1928).
[3] Peterson and Fred *et al.*, *J. Agr. Research*, **34**, 79-95 (1927); **35**, 1021-1038 (1927).
[4] Peterson and Fred *et al.*, *ibid.*, **39**, 285-292 (1929).
[5] Fred and Peterson, *J. Bact.*, **7**, 257-269 (1922).
[6] N.Y. State Agr. Expt. Sta., *Tech. Bull.* **169**, 3-29 (1930).
[7] *Canning Age*, **7**, 121-123; 353-356 (1926).
[8] Russo, *Boll. soc. ital. biol. sper.*, **5**, 490-492 (1930).
[9] *J. Bact.*, **4**, 177-182 (1919).
[10] Fabian, *Fruit Products J. and Amer. Vinegar Ind.*, **9**, 219-220; 231 (1930); Joslyn, *ibid.*, **6**, 22-23 (1927).
[11] California Agr. Expt. Sta., *Bull.* **498**, 3-42 (1930).
[12] *Glass Container*, **7** (x.), 5-38 (1928).
[13] *Food Inds.*, **2**, 61-64 (1930).
[14] *Glass Packer*, **2**, 497-499 (1929).

Egg Preserving

THE staling of eggs is known to be connected with the porosity of the shell; accordingly, many of the simpler preservative methods aim at sealing these pores.

Pickling in lime water is carried out on a very large scale, particularly on the Continent, where concrete tanks capable of holding from 15,000 to 150,000 eggs are built for the purpose. The preserving operations, naturally, are carried on during the time of heaviest supplies, from April onwards. The eggs are candled and all stale or cracked rejected. The eggs remain in the pickling solution until removed for use or sale.*

For smaller quantities water-glass (sodium silicate) is a more convenient pickling agent than lime water. According to one authority, a 10 per cent. solution will preserve eggs for three to five months. The pickling is usually done in portable iron tanks, care being taken to see that all eggs are fully covered and that the tanks are clean and sterile before filling. One gallon of solution should cover 50 doz. eggs if they are properly packed. A cool atmosphere is essential for the room in which the egg pickling tanks are situated, otherwise silica is likely to be deposited on the shells.

* All chemically preserved or pickled and oiled eggs are required to be so marked on the shell (Agricultural Produce [Grading and Marking Act] 1928, Section 3).

Less commonly adopted are systems in which the shell is covered by a film of wax, heavy oil, or grease.

The cool storage of eggs under refrigeration (as distinct from freezing) is a more complicated process, but it gives better results than any of the foregoing methods. In brief, the principle lies in keeping the eggs in store-rooms at 35° to 45° F. with a humidity of 65 to 75 per cent. The cold storage of eggs is a subject on which widely varying opinions are held as to the correct conditions, and the design of stores for them is certainly a task for the expert. It is essential that gentle air circulation should exist to prevent mould growths, while care must be taken to prevent the odours of other produce, packing materials, or of the timber or insulation work of the room, being absorbed by the eggs. When stored at the lower range of temperatures the eggs have to be "acclimatised" carefully when removed from storage. For the average producer it would be more economical to rent space in a public cold store (there is a surplus of it available) than to install his own plant. The rate in London, which is a few pence dearer than provincial centres, is about 4s. 1d. per long case (1,440 eggs) for the first month and 1s. 2d. for each successive week or less. Quarter cases (360 eggs) are stored for 1s. 2d. per month in London and slightly less in the provinces.

The "Food Industries Manual"

THERE has always been a widespread need for a reference book covering the manufacturing side of the food industries. This has been amply demonstrated by the large number of requests we have received for expert guidance in overcoming technical and manufacturing difficulties, in the selection of plant for specific purposes, and in many other matters, including packing, references to literature, food laws, and recipes.

Prior to the publication of the *Food Industries Manual* there was, in fact, no book of this comprehensive and practical nature available. The *Food Industries Manual* made its first appearance in January, 1931, and was warmly welcomed by all sections of the industry. Requests for copies were made from all parts of the world, and in the space of a few months it had established itself as the standard work of reference in all matters appertaining to the practical manufacture of foodstuffs.

This extremely favourable reception induced the publishers to bring out a new edition of the work, completely revised and considerably enlarged. It is now a work of 322 pages, measuring 11 inches by 8½ inches, and for purposes of ready reference is divided up into the following sections:

Wheat, Milling, Flour, Baking, and Flour Confectionery.
Sugar Confectionery, Chocolate, Jams, and Jellies.
Fruit and Vegetable Canning.
Meat Products, including Canning, Preserving, Curing, etc.
Packing, including Packing Materials, Containers, and Machinery.
Food Storage and Refrigeration, including Insulation, Air Conditioning, etc.
The Composition of Foods.
Company Returns and Financial Statistics of Food Manufacturing and Distributing Companies.
Bibliography of Technical and Industrial Books.
Advertisers of plant, machinery, products, and general equipment for food manufacture.
Alphabetical list of firms.
Classified index of manufacturers and suppliers of raw materials, products, plant, and equipment.
Trade and registered names.

The subject-matter comprised within each section has been arranged alphabetically, and other steps have been taken to enable the enquirer to turn up the information he is seeking in the shortest possible space of time and with the least amount of trouble. As a technical and commercial compendium on the manufacture, preserving, packing, and storage of food products it is indispensable to every food manufacturing concern, and, indeed, to everyone in any way connected with the industry. The reliability of the information contained in this work is vouched for by the fact that the compilation has been in the hands of H. B. Cronshaw, B.A., Ph.D., A.I.C. (the Editor of FOOD MANUFACTURE), assisted by F. Hirst, M.Sc., A.R.C.S. (Director of the Fruit and Vegetable Research Station, Campden), W. B. Adam, M.A., A.I.C. (also of the Campden Station), T. H. Fairbrother, M.Sc., F.I.C., and A. Samson, A.R.C.S., A.I.C., who are all well-known contributors to this journal.

This encyclopædic work is sold exclusively to food manufacturers at a price of 10s. and is obtainable from Leonard Hill, Ltd., 231, Strand, W.C. 2.

BANANA PRODUCTS » »

A BRIEF REVIEW »

(See Enquiry on p. 186)

A Banana Grove in Queensland.

Figs.—This term is applied to the dried whole banana. For this purpose the ripe fruit, in which most of the starch has changed into sugar, is used.

The simplest drying method is by exposure to the sun. The peeled fruit is laid in rows on trays or in boxes, care being taken to avoid contamination by insects and dust. The fruit is covered up at night and in cloudy weather. Boxes or frames covered with glass can be used, provided that arrangements are made for free circulation of air in order to avoid condensation of moisture.

In most cases the use of drying plant of the type employed in the drying of fruit is to be recommended. Such plant is best designed in accordance with the special requirements and conditions which are involved. Generally speaking, a system employing hot air circulated by fans is suitable, care being taken that the temperature does not at any time rise above 140° F. The proportion of moisture in the finished product is commonly about 20 per cent. In order to ensure good keeping qualities, it should not exceed this figure, and should preferably be less.

Dried bananas which are sticky and have a dark colour are commonly marketed. Attempts have been made to improve the colour, and it is stated that good results have been obtained by slicing the fruit lengthwise and exposing it to the fumes of burning sulphur for 20 minutes before drying. Another point which would help sales is to see that the figs are more uniform in quality and size than is commonly the case. Also, dried bananas are usually received in this country in wooden boxes containing 28 lb. and 56 lb., but it would seem that there are advantages in packing the product in cartons with attractive labels. At all stages, special precautions should be taken to avoid insect infestation.

Banana Chips.—These are made by thoroughly drying "green" bananas, and are of such hardness and consistency that they can readily be ground to flour. Fully grown unripe (or "three-quarter ripe") fruit is peeled, this operation being facilitated by first immersing the fruit in very hot (but not boiling) water. The knives used are of bamboo, or of nickel or stainless steel.

The fruit, either whole or cut into slices, is then dried so that the product contains not more than 10 per cent. of moisture. The chips can be shipped quite satisfactorily in jute sacks. Weevils apparently do not get into the product, either during transit or in this country.

Banana Flour.—This is prepared in the consuming country from imported chips. In Jamaica, flour has been made direct from peeled bananas by drying them in a vacuum apparatus fitted with a system of rotating paddles and fixed knives. The disintegrated material so obtained was sieved and the coarse fractions ground in mills until the whole was reduced to the desired degree of fineness.

Uses.—It appears that there is practically no market in this country for imported banana flour for the following reasons:

1. Users require flour milled to their own specifications.
2. Imported flour is generally unsatisfactorily milled.
3. Chips are more conveniently shipped.
4. Flour may be adulterated.

Banana flour milled in this country is used almost entirely for invalid foods, biscuits, etc. A very small quantity is used in other proprietary articles. A few years ago, efforts were made to popularise the use of banana flour in ordinary household cooking for cakes, biscuits, etc., but apparently this attempt has been unsuccessful. On the Continent, however, there is a greater demand, the flour being used for purposes other than the manufacture of foodstuffs.

Banana chips must be of first-class quality, otherwise they are practically worthless. Bad and weevilly material can only be sold at low prices for cattle feeding.

The Role of Acidity in Food Preparation

By PROFESSOR W. V. CRUESS
Fruit Products Laboratory, University of California.

The following is an account of experiments which appear to prove that the toxicity of weak acids to micro-organisms depends upon the reaction (acidity or pH value) of the food. Thus benzoic acid, acetic acid, sulphurous acid, and salicylic acid in low concentrations prevent growth of micro-organisms in acid solutions, while at neutrality they appear to lose their toxicity.

It would therefore appear that the free acids, and not their salts or their ions, are the preservative agents.

Salts and formaldehyde represent two other classes of compounds and, in support of the above theory, their preservative action is little affected by the pH value of food.

PART II.—ITS EFFECT ON PRESERVATIVE ACTION

SODIUM BENZOATE, sulphurous acid, acetic acid (vinegar), salt, and sugar are commonly used, permissible food preservatives. Added salicylic acid, boric acid, and formaldehyde are not permitted in foods in the United States.

Manufacturers of such food products as Maraschino-style cherries and grapes and crushed or cubed melon preserves for confectioners' and ice-cream makers' use have encountered considerable loss by fermentation of their products, even when they have contained the customary $\frac{1}{10}$ of 1 per cent. of sodium benzoate. In our laboratory experiments also we have observed at various times marked irregularities in the keeping quality of various fruit products to which benzoate or sulphurous acid were added as preservatives. It was noted that acid foods such as apple juice, grape juice, and crushed sour fruits were readily preserved by $\frac{1}{10}$ of 1 per cent. of sodium benzoate, whereas products of low acidity such as ripe olives (*p*H value 7 to 7·5), avocado pulp, and non-acid vegetables invariably decomposed. Previous investigators have given their attention principally to the effect of *p*H value on the disinfecting (killing) power of various disinfectants, rather than to its effect on preservative action. (See list of references.)

Experiments with Pure Cultures.

In order to establish more definitely the relation between preservative action and reaction of the food, a number of systematic experiments were conducted, in one series with pure cultures of various food spoilage organisms added to sterilised media, and in the other with mixed cultures in natural food products.

The results of these experiments may be summarised as follows. At *p*H 2·5 (a very acid reaction in so far as food products are concerned) approximately 0·03 per cent. of sodium benzoate sufficed to prevent the growth of wine yeast (*Saccharomyces ellipsoideus*), *Mycoderma yeast* (2 species), *Penicillium mould* (2 species), *Mucor mould*, and vinegar bacteria. The lactic culture used failed to grow at *p*H 2·5. Apple juice was used as the medium.

At *p*H 3·0 the concentration of benzoate growth became 0·06 for most of these micro-organisms. At *p*H 4·0 there was required 0·08 to 0·10 per cent. of the preservative. At *p*H 4·8 to 5·0 the concentration required to prevent growth varied with the organism used from 0·25 per cent. to 0·4 per cent. At *p*H 5·2 it varied from 0·45 per cent. to 0·7 per cent. At *p*H 6 growth occurred in all cultures with all concentrations of benzoate used, the maximum used being 1·5 per cent. At *p*H 7·3 there was required from 3·2 to 3·4 per cent. of the preservative to prevent growth.

Thus, at *p*H 7·3 there was required 100 times as much benzoate to prevent growth as at *p*H 2·5, and about 34 times as much as at the normal *p*H value of fruits—namely, *p*H 4.

The experiments were repeated with acid intolerant micro-organisms—that is, *Bacillus coli*, *B. subtilis*, *B. sporogenes*, and *B. botulinus*. None of these organisms grew at *p*H 4·0, even in the absence of benzoate. However, in their range of growth, it was found that the preservative effect of the sodium benzoate depended upon the *p*H value. Thus, at *p*H 4·5 there was required 0·04 to 0·06 per cent. of benzoate to prevent growth of *B. coli* and *B. sporogenes*; at *p*H 5·0, 0·12 per cent.; at *p*H 5·7, 0·6 to 0·8 per cent., and at *p*H 7·3, 2·40 to 2·60 per cent. of benzoate. *B. subtilis* was slightly less resistant.

B. botulinus grew and produced fatally potent toxin at *p*H 7·4 in a medium containing 0·8 per cent. of sodium benzoate, whereas at *p*H 4·7 and 0·1 per cent. benzoate growth failed to occur, the medium remaining non-toxic. Other experiments showed also that the retarding effect of sodium benzoate on yeast fermentation is affected markedly by the *p*H value of the fruit juice.

Sodium Salicylate.—Similar experiments were conducted with sodium salicylate as the preservative and grape juice as the culture medium. The results paralleled very closely those obtained with sodium benzoate. At *p*H 2·5 there was required 0·02 to 0·04 per cent. sodium salicylate to prevent growth, at *p*H 3·5 to 3·8, 0·06 to 0·15 per cent.; and at *p*H 7, as much as 3 per cent. sodium salicylate failed to prevent growth. Pure cultures were used.

Sulphurous Acid.—At *p*H 2·5 there were required

only 100 to 300 parts per million (0·01 to 0·03 per cent.) to prevent growth; at *p*H 3·5, 300 to 800 p.p.m. (0·03 to 0·08 per cent.); and at *p*H 7·0, 5,000 p.p.m. (0·5 per cent.) failed to prevent growth of pure cultures of yeasts, moulds, vinegar bacteria, and lactic bacteria.

Acetic Acid.—Growth of yeast and mould was prevented by 0·8 to 1·0 per cent. of acetic acid at *p*H 3·5, whereas at *p*H 7 an acetate concentration equivalent to 3 per cent. of acetic acid failed to prevent growth. Potassium acetate was used at *p*H 7·0. Similar results were obtained with the other organisms.

Salt (Sodium Chloride).—*p*H value affected the preservative action of salt only moderately to slightly. Thus yeast growth was prevented by 14 per cent. salt at *p*H 2·5, while 20 per cent. was required at *p*H 7·0; for blue mould 18 per cent. was required at *p*H 2·5 and 20 per cent. at *p*H 7·0. For *p*H 3·5 the values were intermediate. Similar results were obtained with the other organisms.

Formaldehyde.—The preservative action of formaldehyde, like that of salt, was not markedly affected by the *p*H value. Growth at *p*H 2·5 was prevented by 0·015 grams per 100 c.c., while at *p*H 3·5 and 7·0 there was required from 0·015 to 0·030 grams per 100 c.c.

Sugar.—Preliminary tests with sugar indicate that its preservative action against yeasts and moulds is not greatly affected by the *p*H value of the medium.

Experiments with Various Food Products.

In the following practical tests pure cultures were not used, except with melon preserves. As with the pure cultures and the liquid culture media described earlier, it was found that preservative action depended to a rather amazing degree upon the *p*H value of the food. In all cases the *p*H value was artificially controlled to various *p*H values by acidification with citric acid or by partial neutralisation with sodium hydroxide.

Melon Preserves.—Considerable spoiling of this product by yeast and mould has occurred commercially in the presence of $\frac{1}{10}$ of 1 per cent. of sodium benzoate. A penicillium mould and aspergillus mould, both isolated from spoiled melon cubes, a culture of the same yeast used in other experiments reported in this paper, and a pure culture of vinegar bacteria isolated from cider vinegar, were used.

The preserves were packed in 4-oz. wide-mouth jars in syrups to which various amounts of citric acid or sodium hydroxide were added to give a range of *p*H values from 2·5 to 7·6. The jars were sealed with screw caps and sterilised at 100° C. Fourteen *p*H values were compared. The range of benzoate concentration was varied, according to the *p*H value concerned.

The sterilised samples were inoculated with the pure cultures previously mentioned and were stored at room temperature. Observations over a period of several months indicated that the preservative action of the sodium benzoate was affected by the *p*H value as follows: At *p*H values of 2·5 to 3·12 only 0·02 per cent. of sodium benzoate was required to prevent growth of all four organisms; at 3·3 to 4·0, 0·05 per cent. was required; at *p*H 4·5, 0·1 per cent. was required; at *p*H 6·0, 2 per cent. was required; and at *p*H 7·6, 5 per cent. of sodium benzoate was required. Approximately 250 times as much benzoate was required to preserve the melon cubes at *p*H 7 as at *p*H 2·5 to 3·12. The penicillium mould proved somewhat more resistant than the three other micro-organisms used.

Maraschino-Style Grapes.—This product, like the cubed melon preserves, has occasionally spoiled, although containing 0·1 per cent. added sodium benzoate. The spoiling is usually caused by yeast, and accordingly this organism was used in our experiments. Results similar to those reported for the cubed melon were obtained. Acidification of the product with as little as 0·25 per cent. of citric acid made it possible to preserve heavily inoculated samples with 0·1 per cent. sodium benzoate. Non-acidified samples underwent fermentation in the presence of many times this concentration of the preservative. When acidified with 0·5 per cent. of citric acid, yeast growth was prevented by 0·05 per cent. of sodium benzoate.

Ripe Olives.—Manzanillo olives pickled by the California ripe olive process were placed in glass-top fruit jars in brine containing 3 per cent. sodium chloride. One lot of brine was acidified with 0·5 gram of lactic acid in 100 c.c., another with 1 gram of lactic acid in 100 c.c., and another with 1 gram of acetic acid in 100 c.c. A fourth lot was not acidified. Various amounts of sodium benzoate were added and the jars sealed and incubated at 35° C. for two months. At the time of filling the jars, some of the olives in each jar showed bacterial decomposition; as an additional inoculation no precautions were taken to prevent contamination of the brine, jars, and olives at the time of packing. The *p*H determinations were made at the end of the storage period. At *p*H 5 there was required 0·6 per cent. of benzoate; at *p*H 4·0, 0·1 per cent.; and at *p*H 3·8, only 0·05 per cent. to prevent bacterial spoilage.

Artichokes.—Artichokes were packed in 3 per cent. sodium chloride solution to which 0·1 per cent. of sodium benzoate and various proportions of lactic and acetic acid were added. The glass containers were sealed and stored at room temperature for two months. At *p*H 6 to 3·9 the 0·1 per cent. of benzoate added to the brine failed to prevent growth of bacteria and mould, but at *p*H 3·6 and 3·4 growth was prevented by this initial concentration of the preservative. After equilibrium between the artichokes and brine was established the benzoate concentration was approximately 0·06 per cent.

Avocado Pulp.—As the flavour and texture of avocados deteriorate badly after sterilisation by heat, preservation by sodium benzoate is possibly of economic importance.

Avocados were peeled and ground fine. To 100-gram portions of the pulp were added various amounts of sodium benzoate and an organic acid (either citric or acetic). The samples were stored at room temperature in sealed jars for ten months and examined at intervals to determine whether growth of micro-organisms had occurred.

As in experiments with olives and artichokes, the *p*H values affected the concentration of sodium benzoate required for preservation, 0·3 per cent. being

required at *p*H 5·2 and only 0·06 per cent. at *p*H 3·8 when citric acid was used for acidification. Acetic acid, as is well known, itself exerts a preservative effect. This fact was well shown when 1·5 per cent. of acetic was added. No benzoate was required at this concentration of acetic acid. At *p*H 4·6, obtained with 1 per cent. acetic acid, only 0·06 per cent. benzoate was required, whereas at *p*H 4·5, obtained with citric acid, 0·15 per cent. benzoate was required for preservation. Semi-commercial experiments made in co-operation with the California Avocado Association confirmed these results.

Similar experiments made with sliced avocado flesh in brine containing 3 per cent. of salt and various concentrations of sodium benzoate and acetic or citric acid gave essentially the same results as with the pulp.

Prune Pulp.—This product is sold for use in soda fountains and should keep for several weeks in open containers. It was found that 0·3 per cent. of sodium benzoate was required to prevent spoilage of non-acidified pulp heavily inoculated with yeast and mould. That acidified with citric acid and similarly inoculated kept well with 0·18 per cent. of benzoate.

Pulp mixed with an equal volume of cane sugar syrup of 57° Balling and not inoculated (except by natural contamination) was preserved with 0·1 per cent. of benzoate, whether acidified or not. No *p*H determinations were made owing to the interfering effect of colour and consistency of the product.

Carbonated Beverages.—Carbonated bottled fruit beverages were prepared from apple and orange syrups of *p*H 2·0, 3·5, and 7·0. Benzoate concentrations in the bottled beverages were varied from 0·01 to 0·1 gram in 100 c.c. In beverages made from syrups of *p*H 7, growth of micro-organisms and spoiling occurred at 0·1 gram of benzoate in 100 c.c. In beverages made from the syrup of *p*H 3·5, growth was prevented by 0·08 gram of benzoate in 100 c.c. and by 0·02 gram of benzoate in 100 c.c. in those made with syrup of *p*H 2·0. Bacterial growth was more abundant than that of yeast in the carbonated beverage made from syrups of *p*H 7·0.

Asparagus.—In one experiment fresh white asparagus stalks were ground and pressed. The *p*H values of 1,000 c.c. portions of the juice were adjusted to values ranging from 3 to 9 by the addition of citric acid or sodium hydroxide. To 50 c.c. portions of the juices of *p*H 4·9 to 9 were added from 0 to 4 grams of sodium benzoate per 100 c.c., and to samples of *p*H 3·0 to 4·0 were added from 0 to 0·2 gram per 100 c.c. The juice was heavily contaminated with soil adhering to the stalks.

During incubation, frequent macroscopic observations and microscopic examinations were made. Growth occurred at 4 per cent. sodium benzoate and *p*H 9, but was prevented at the other *p*H values by the following concentrations, expressed as grams in 100 c.c.; at *p*H 8 was required 8 grams; *p*H 6·7 (natural juice), 0·8 gram; *p*H 6, 0·8 gram; *p*H 4·9, 0·4 gram; *p*H 4, 0·06 gram; *p*H 3·5, 0·03 gram; and *p*H 3·0, 0·03 gram. Thus, at *p*H 9 more than 130 times as much benzoate was required to prevent growth as at *p*H 3·5.

To tubes, in duplicate, of the freshly prepared asparagus juices, described above, was added a layer of neutral mineral oil to provide anaerobic conditions. The tubes were sterilised, and were then inoculated with an active culture of *Bacillus botulinus* grown in brain medium. The culture before use was proved to be rapidly fatal to guinea-pigs fed in small amount by mouth. The spore suspension was detoxified by heat before use. The tubes of asparagus juice were incubated at 37° C., and growth observed at four weeks and at six months by macroscopical observation, microscopical examination of stained mounts, and by odour. Growth, apparently that of *B. botulinus*, occurred at *p*H 8·6 and 2 grams benzoate in 100 c.c.; *p*H 7·4 and 1 gram; *p*H 5·2 and 0·1 gram; *p*H 4·7 and 0·5 gram benzoate in 100 c.c.; but no growth occurred at *p*H 4 even in the absence of benzoate. Growth was negative at *p*H 8·6 and 3 grams benzoate in 100 c.c.; *p*H 7·4 and 2 grams; *p*H 5·2 and 0·2 gram; *p*H 4·7 and 0·075 gram of benzoate in 100 c.c. The *p*H values represent those taken after sterilisation, as they were found to have changed greatly during heating. When compared with the unheated samples previously described, it will be seen that in general *B. botulinus* behaved similarly to the micro-organisms naturally occurring on asparagus with respect to the effect of *p*H value of the medium on the preservative action of sodium benzoate. However, among the naturally occurring organisms there were many that were acid tolerant, consequently they grew at lower *p*H values than *B. botulinus*.

In confirmation of the foregoing observations, it was found that sterilised asparagus juice of *p*H 7·4, and containing 0·8 gram of sodium benzoate in 100 c.c. inoculated with detoxified spores of *Bacillus botulinus*, became toxic on incubation, as proven by its fatal effect on guinea-pigs fed by mouth. At *p*H 4·7 and 0·1 gram benzoate in 100 c.c. the inoculated juice did not become toxic. The non-toxicity of the detoxified spores was proved by feeding tests; before detoxification by heating at 80° C., the culture was extremely toxic to guinea-pigs; after this treatment it was non-toxic.

In experiments made with asparagus stored in brines of various *p*H values, and various concentrations of sodium benzoate, similar results were obtained.

Peas and String Beans.—Results similar to those obtained with other non-acid vegetables were obtained with fresh, shelled, green peas and with fresh, cut string beans stored in dilute brine. It was found impossible to prevent spoilage of the nonacidified vegetables with reasonable concentrations of sodium benzoate.

Tomatoes.—One-tenth of 1 per cent. of benzoate preserved this vegetable satisfactorily against spoiling by micro-organisms, although excessive softening by enzyme action rendered the vegetables unsuitable for use in salads. The natural, relatively low *p*H value (in this experiment, 4·0) rendered the benzoate effective without acidification.

Danger of Food Poisoning.—It is evident from the results obtained with olives, avocado pulp, and asparagus juice that *Bacillus botulinus* can probably develop and form toxin in the non-acidified products containing 0·1 per cent. or more of sodium benzoate. Suggestions made that non-acid food products be

(*Continued on page* 181.)

The MANUFACTURE of

FISH PASTES

IT IS not uncommon to receive requests for recipes for fish pastes; sometimes the particular type of paste—bloater, salmon, shrimp, and so on—is specified; more generally, no indication is given as to just what the enquirer has in mind. It is obviously unsatisfactory to quote bare recipes, as, without minute directions of procedure, one may obtain all manner of results starting with the same ingredients—even in the same proportions. In any case, the most satisfactory way in the long run is for the enquirer to make up his mind as to what type and grade of paste he is aiming at, what raw materials are at his disposal, and then to set out to make himself conversant with the principles involved in the preparation of fish pastes in general. After that, he should take off his coat and get down to practical work, varying the ingredients and their proportions, studying the results, and trying to understand the reasons for any variations and peculiarities.

If this experimental work is intelligently planned, it will yield data of great value and enable the experimenter to arrive ultimately at a satisfactory product falling into line with his own particular requirements and conditions.

With these points in view, we give the following general account of underlying principles.

The chief ingredient and basis of all fish pastes is canned salmon. Occasionally a certain proportion of fresh fish is incorporated, usually herring, which is the most suitable for the purpose. Some fish, such as cod and hake, make the paste too dry. Also, red herrings are used extensively as they impart a rather high flavour.

The next important ingredient is fat, whose main function is to facilitate spreading, for a paste must have good spreading properties. The fat commonly employed is beef fat. It would appear, however, from an examination of recipes, that in U.S.A. bacon fat is the one usually employed. Butter is sometimes used, but, actually, there is no advantage in flavour to be gained by using this fat. It is almost impossible to say whether a particular paste has been made up with beef fat or with butter—that is, when judged by flavour alone.

The majority of pastes contain a certain proportion of farinaceous material, which serves a useful purpose in that it absorbs excessive moisture and renders the paste firm. Four to five per cent. is ample. Generally, the material consists of ground rice, or biscuit meal, or some proprietary preparation.

The question of flavouring is an important one, and it is here that the manufacturer has wide scope for the exercise of ingenuity. An attractive background may be created by the incorporation of a small proportion of well-matured anchovies, and for this purpose Gorgona are the best. Alternatively, one may use lobster tomali, which possesses high, though pleasant, flavouring properties. In shellfish pastes a certain proportion of canned crab or lobster, or perhaps crayfish, may be employed. In order to secure a shrimp-like flavour, one may add either shrimp extract or shrimps barrelled in brine, although the latter are not always available.

As regards seasoning, salt, white pepper, mace, and coriander are the chief ones used; occasionally ginger is a constituent.

The most satisfactory colours for pastes are the rhodamines, as these are resistant to retorting, and also to the influence of sunlight when the paste is packed in glass. Many artificial colours lose their intensity during the preserving process, but the rhodamines are found by experience to be stable under these conditions.

The first stage in manufacturing operations consists in mixing together the various ingredients. This may be carried out in any form of mixing machine, such as one used for cake mixing, which gives a thorough and efficient mixing.

Then the material is passed through a mincing machine, and filled into jars from a sausage-filling machine, after which the jars are capped and preserved for ½ hour at 240° F. This treatment is given both large jars (3-oz capacity) and small jars (1½-oz capacity).

Piccalilli Manufacture

By JOHN ELSBURY

THE FIRST step in the successful preparation of piccalilli of good quality is to see that all the vegetables and other ingredients are of good quality and in sound condition.

Operations are commenced by running off the brine from the vegetables. Fill the cask with hot water at about 180° F. and allow to stand for 10 to 12 hours, so as to extract all salt from the vegetables. If it is desired to colour the cauliflower, place 4 oz. of turmeric in the first pail of hot water and stir well. Should the colour of the cauliflower be objectionable, an improvement may be effected by the addition of 1 oz. of meta-bisulphite of potash.

Next day the vegetables should be cut up and placed in a cask with acetic acid and water, made up in the proportion of 1 gal. of 80 per cent. acetic acid to 18 gal. of water. Allow this to stand overnight and then drain—which is best done in baskets.

Piccalilli Liquor.

48 gal. of 16 gr. vinegar.
36 lb. best mustard.
6 lb. gum tragacanth.
3½ lb. turmeric.
1 lb. curry powder.
1 lb. ground ginger.
7 lb. table salt.
4 lb. fine chopped shallots.
1½ lb. of fine chopped garlic.
20 lb. granulated sugar.

Place 6 lb. of gum tragacanth in 12 gal. of 16 gr. vinegar and allow to stand 24 hours, stirring up two or three times. Now put the rest of the vinegar in an enamelled pan and rub the gum into it through a sieve. Next add the sugar, salt, garlic, and the shallots, and stir well. Then add the spices, turmeric, and mustard through a fine sieve and gently bring to the boil, simmering for 15 minutes. Pass the whole through a sieve into a tub and allow to stand until cold, after which stir.

The best procedure to adopt in filling is first of all to half-fill the jars or bottles with the piccalilli liquor and then add the drained vegetables, pushing them into the liquor with a wooden stick. Care should be taken that all vegetables are well immersed in the liquor, otherwise there is danger of mould setting in. Precaution should also be taken that the vegetables are well drained before filling, in order to avoid separation. The containers should now be corked and sealed as soon as possible, so as to prevent any moisture from settling on the top. The jars should be perfectly dry before filling, and if the corks are to be softened this should be done by the use of hot vinegar —not water.

Vegetables for Best Piccalilli.

1 cask of cauliflower.
⅛ cask of bastards.
⅛ cask of chumps.
1/12 cask of beans.
1/10 cask of gherkins.
1 gal. of West Indian pickle.
1 gal. garlic (very fine).
1 gal. mangoes (very fine).
1 gal. pickled lemons.
⅛ cask of No. 0 silver skin onions.

Mix well together before putting into acetic acid and water. Do not cut the onions.

Piccalilli (Superfine).

6 lb. gum tragacanth.
45 gal. of 16 gr. vinegar.
36 lb. best mustard.
7 lb. imported curry powder.
7 lb. of turmeric.
20 lb. of granulated sugar.

Method as for best piccalilli.

Vegetables for Superfine Piccalilli.

½ cask of cauliflower.
⅛ cask of No. 3 gherkins.
½ cask of chumps.
2 gal. of mangoes and brine.

Cut up the above and then add:

⅛ cask of very fine gherkins.
⅛ cask of No. 0 silver skin onions.

Mix well together before putting into acetic acid and water.

Cut small for glasses.

Cut large for half-gallons and gallons.

Piccalilli Liquor with Rye Flour.

50 lb. of dark rye flour.
60 lb. of mustard.
12 lb. of turmeric.
60 lb. table salt.
40 lb. of granulated sugar.
½ lb. of cayenne.
1 gal. of caramel.
94 gal. of 24 gr. vinegar.
8 oz. of soluble extract of cloves.
10 oz. of soluble extract of pimento.

Place 50 gal. of the vinegar in a mixing machine (a butter churn is suitable for the purpose) and set it in motion. Now add the flour, mustard, turmeric, and cayenne, and mix well together. Place the rest of the ingredients, with the exception of the extracts, in a vat fitted with an open coil and just bring to the boil. Shut off the steam and add the contents of the mixer and stir well. Turn on the steam and gently boil for 3 minutes, after which the steam is cut off and the

extract added. Stir well and pass through a fine sieve into the tubs, and allow to cool.

Vegetables to be cut up.

1 cask of cauliflower.
½ cask of chumps.
½ cask of bastards.
½ cask of cutting onions.

Vegetables to be Cut Up for Piccalilli from Sago Flour.

This is a good, but cheap, piccalilli.

2 casks of cauliflower.
½ cask of bastards.
½ cask of chumps.
½ cask of cutting onions.
¼ cask of small gherkins.
½ cask of No. 2 onions.

Cheap Piccalilli with Sago Flour.

Pour 28 gal. of water into a pan with:

3 lb. of mustard.
1½ lb. of turmeric.
3 oz. of ground mace.
12 oz. of curry powder.
4 oz. of cayenne.
4 lb. of table salt.

Gently simmer for 30 minutes with the pan covered. Then place 14 lb. of sago flour in a small tub with sufficient cold water to mix it into a thin batter. Run the sago batter into a pan while still boiling. Stir well and continue boiling until it thickens. Cut off the steam and add ½ gal. of 80 per cent. acetic acid while stirring. Then run the product through a sieve into a tub and allow to cool.

A Good Piccalilli.

8 lb. of gum tragacanth.
34 lb. of 20 gr. vinegar.
9 gal. of water.
3 gal. of 30 per cent. acetic acid.
10 lb. of table salt.
20 lb. of granulated sugar.
5 lb. of curry powder.
7 lb. of turmeric.
6 oz. of cummin seeds.
8 oz. of cayenne.
35 lb. of mustard.

Soak the gum in 16 gr. vinegar for 24 hours. Run the vinegar, water and acid into an enamelled pan, together with the sugar and salt, and dissolve. Rub the gum through a sieve into this mixture. Stir well. Then add the spices, etc., through a fine sieve and bring to the boil. Pass the product through a sieve into a tub and allow to cool.

The vegetables as for best piccalilli.

Bombay Gherkins in Piccalilli.

Run the brine from a cask of No. 3 gherkins. Soak them in hot water for 24 hours; then cut them in half lengthwise. Scrape out the centres and stuff. Then tie together with string.

A stuffing for Bombay gherkins is made up as follows:

To each 10 lb. of centre removed add 10 lb. fine chopped onions, 1 oz. fine chopped garlic, ¼ oz. of cayenne, and bind well together with a sweet syrup, consisting of 10 lb. of granulated sugar and 1 gal. of 16 gr. vinegar brought to the boil and allowed to cool.

When stuffed and tied, place in jars and cover with the best piccalilli liquor.

The Rôle of Acidity in Food Preparation (*continued from page 178*)

preserved by sodium benzoate are, therefore, ill advised and dangerous.

Growth in 10 per cent. Sodium Benzoate Solution.—A bottle containing about 400 c.c. of 10 per cent. sodium benzoate was stored at room temperature for about a year. During this period it developed a cottony growth of mould. On plating on nutrient agar-agar the mould proved to be *Penicillium glaucum*, ordinarily known as "Blue Mould." The *p*H value was 7·5. This indicates extreme resistance in neutral solution.

REFERENCES.

Herter, C. A., "The Action of Sodium Benzoate on the Multiplication and Gas Production of Various Bacteria." *J. Biol. Chem.*, **3**, 59-67, 1910.

Bernard, H. E., "Sodium Benzoate as a Preservative in Food." *Chem. Eng.*, **12**, 104, 1911.

Held, D., "The Preserving Action of Benzoic Acid." *Arch. Hy.*, **84**, 289, 1915.

Perry, M. C., and Beal, A. D., "The Quantities of Preservatives Necessary to Inhibit and Prevent Alcoholic Fermentation and the Growth of Moulds." *Jour. Ind. and Eng. Chem.*, **12**, 253, 1920.

Bouacorsi, L., "The Influence of the Culture Medium upon the Inhibiting Action of Chemical Substances." *Zeitschr. Hyg. Infekt.*, **99**, 284, 1923.

Fleischer, L., and Amster, S., "Upon the Influence of the Reaction of the Medium upon the Disinfecting Action of Organic Dyes." *Zeitschr. Immunitats.*, **37**, 327, 1922.

Waterman, H. I., and Kniper, P., "The Antiseptic Action of Benzoic, Salicylic, and Cinnamic Acids and their Salts." *Rec. Trav. Chim.*, **43**, 323, 1925.

Kuroda, T., "The Influence of Hydrogen Ion Concentration upon the Antiseptic Action of Several Phenols and Aromatic Acids." *Biochem. Z.*, **169**, 281.

Cruess, W. V., and Richert, P. H., "Effect of Hydrogen Ion Concentration on the Toxicity of Sodium Benzoate to Micro-organisms." *Jour. Bact.*, **17**, No. 5, 363-371, 1929.

Cruess, W. V., "The Relation of *p*H Value and Preservative Action." *The Fruit Products Journal*, April, 1931.

Correspondence

THE LACQUERED CAN-CAN

To the Editor.

DEAR SIR,

It was most refreshing to find in the Editorial Note of the May issue of FOOD MANUFACTURE a strong touch of humour displayed. Scientific and technical journals generally lack this "saving sense," which is to be regretted.

FOOD MANUFACTURE is an excellent journal, full of interest from cover to cover; it is always informative and never dull, and now it crowns its ample proportions with "quips and cranks and wreathed smiles such as wrinkled care beguiles."

This is as it should be. Even Doctors of Science, Research Chemists, and Captains of Industry will laugh if they be tickled.

You suggest, sir, that I should "can" a popular melody. Alas! I am no musician or poet, but I am a bit of a dog at doggerel. How about this?

Clever Katie's canning cakes for cafés,
Such cunning kickshaws kindly Katie cans.
She processes peach fritters, sardines and gin and bitters.
She's worshipped by all food-preserving fans.

Katie sees that all her cans are lacquered.
To quality and service she'll succumb.
To the makers and to Holden she admits that she's beholden,
And the public never gets a toxic "tum."

Having opened the Brighter Food Manufacturing campaign, may I suggest the following subjects for future discussion:

Should Scientists Smile?
Could Chemists Chortle?
Can Canners Can Can?

Yours faithfully,
A. L. MATTHISON,
(ARTHUR HOLDEN AND SONS, LTD.)

[One up for Mr. Matthison! Will anyone else try their hand? It's all good for the trade. So much the better if we can have the music as well. There must be a few more poets and a musician or two among all the readers of FOOD MANUFACTURE.—EDITOR.]

MARZIPAN PRODUCTION

To the Editor.

DEAR SIR,

In the May issue of your esteemed paper, under Enquiry No. 599, concerning the manufacture of marzipan, I find some statements with which I am not in entire agreement.

For the benefit of your readers I am giving you some observations on this subject, which are based on many years of experience.

There are, besides Skuse's *Complete Confectioner*, a few German publications—e.g., *Das Suckerwaren Laborator*—in which a short description of the manufacture of marzipan is given, but none of these will give you much information, and I don't think much is needed, as everything else rests on experience. I think every practical man could fill volumes with his experience without giving very much help to an inexperienced person.

In a few words I shall try to put down the most important rules to be observed.

First of all, extreme cleanliness is to be observed in the manufacture and the packing of the paste. The manufacturing room should be light and airy, entirely separated from any storage place for dried fruits and raw (unblanched) almonds, as these contain germs which cause the so-called "spots" in marzipan. These spots, which appear darker than the rest of the paste, are nothing else than inverted sugar. The inversion of the sugar in a faulty paste generally starts between the third and fourth week after the manufacture and, as time goes on, the spots grow bigger and are an ideal breeding place for mould spores. Such marzipan, when used for moulded or modelled goods or chocolate centres, would probably start fermentation, and even if that should not happen the inversion of the sugar would still go on and result in spoiling the appearance of the marzipan to such an extent that it would be impossible to offer it for sale.

Every layman knows that air which is not sterilised contains all kinds of germs and mould spores. To enclose such air with a moist paste (as marzipan certainly is), in an airtight container, would unavoidably lead to growth of fungus, which would be the worst thing that could happen to marzipan. In the majority of bakehouses where marzipan is mixed with icing sugar for modelling and decorating, the rest of the paste is generaly put in an airtight tin, to be used again the next day, and to prevent it from getting crusty in the meantime. If such a tin is not washed and aired from time to time the marzipan will go sour even if the most perfect raw paste is used. The packing in airtight containers can only be done if they are properly sealed and sterilised. Many firms after long experiments have abandoned this method. There is still an American product in tins on the market, but the paste is rather firm and coarse ground, and does not suit every consumer. A firm paste has naturally better keeping qualities than a softer one.

My own experience in regard to the canning of marzipan is not to use any larger tins than those containing 7 lb. I have kept such tins for about two years and the contents were still in good condition, but the taste does not quite come up to paste packed in boxes. A marzipan manufactured under good conditions and packed in wooden boxes lined with greaseproof paper and stored in an airy and dry place should keep for almost any length of time. Of course, that does not mean that marzipan will improve with age; all foodstuffs are better when they are fresh.

Yours faithfully,
"PRAXIS."

TRADE NOTES

A Cannery for Cork? Plans for Extensive Development.

Discussions now taking place in Ireland between the Cork Farmers' Union, the Cork Chamber of Commerce, and several local capitalists will, according to a correspondent, if successful, lead to the foundation of one of the most important industries the Free State is likely to have for many years. It is proposed that a cannery for handling a percentage of the country's cattle, fruit and other products, and fish landed on the coasts, shall be erected at Cork in the near future.

The primary stage in the development will be the packing of meat, and the supplies for the factory will be drawn mostly from the county of Cork, which is one-ninth the size of the Free State and, naturally, has the largest number of livestock. Should this prove successful, extensions will be made both in this department and for the handling of fruit and fish. Packing for home and export will be undertaken and a tannery will be established as a subsidiary factory.

Several sites are available for the factory buildings, and Cork is ideally situated for the purpose, being a trans-Atlantic port and well served with rail services from all parts of the Free State.

Although the meat extracts and essences part of the trade has not been fully discussed in the initial plans it is believed that it will form an important factor in the company's development.

The project will undoubtedly receive the blessing of the new Free State Government, under the presidency of Mr. Eamonn De Valera, who is anxious for the industrial development of the country and will welcome a scheme which will develop the basic occupation, agriculture, together with industry. It is considered probable that duties will be imposed on foreign canned goods to an extent which will give protection to the home industry when it is being established.

The Free State Government has already organised a company to help fishermen, and this, it is believed, will assist in the development of the cannery by the maintaining adequate supplies of fish at economic prices.

At the present time two other canneries exist in the Free State—Messrs. W. J. Shaw and Sons, Ltd., Limerick (meat packers), and L'Picquet Company, Dingle, Co. Kerry (mackerel canners). Only three manufacturers of tins suitable for the canning industry exist in Free State and one in Northern Ireland.

Despite the fact that financiers have a primary interest in the foundation of the industry, it is believed that the new factory will operate on co-operative lines, with the suppliers providing capital and management to ensure economic conditions and marketing.

* * *

Canadian Processed Cheese Production.

The Dominion Bureau of Statistics at Ottawa reports that in 1931 there was produced in Canada 12,048,012 pounds of processed cheese, of which 1,148,316 pounds was exported. "Processed" cheese is made from ordinary Cheddar cheese, and the process is stated to consist of grinding the cheese, heating it in a jacketed container with agitation, and filling it into the proper receptacles, either directly or with specially designed machinery. It is placed on the market in conveniently sized packages of one-half pound and one-quarter pound.

The number of firms reporting the production of this cheese in 1931 was eight, of which six were located in Ontario and one each in Quebec and Alberta.

* * *

"Home-Produced" Food Campaign.

Arising out of a conference with representatives of leading hotels, caterers, and railway and shipping companies early this year, a committee has been appointed to investigate the possibilities and methods of securing the greater use of home produce by hotels and other large catering establishments and to make recommendations to producers and others concerned. The committee consists of the following: Mr. A. Burdett, The Incorporated Association of Purveyors of Light Refreshments; Mr. A. G. Chifferiel, F.C.A., Hotel and Restaurants Association of Great Britain; Mr. T. A. Clements, Messrs. Spiers and Pond, Ltd.; Mr. W. G. Inglis, Orient Steam Navigation Co., Ltd.; Mr. V. Joseph, Messrs. J. Lyons and Co., Ltd.; Mr. G. Reeves-Smith, Savoy, Claridge's, and Berkeley Hotels; Mr. Arthur Towle, C.B.E., L.M. and S. Hotel Services; Sir Francis Towle, C.B.E., Gordon Hotels, Ltd.; Mr. R. C. Vaughan, Honywood Hotels, Ltd., and other hotels.

Earl de la Warr, Parliamentary Secretary, Ministry of Agriculture and Fisheries, has consented to preside over the committee. The secretary is Mr. G. H. Higgs, of the Ministry of Agriculture and Fisheries.

The committee will probably arrange to consult representative persons and bodies engaged in the production and processing of home-produced foodstuffs.

National Mark for Bottled Fruits.

The representative Trade Committee which advises in regard to the administration of the National Mark scheme for canned fruit and vegetables is to undertake similar duties in regard to the new scheme for bottled produce. For this purpose, the committee has been reconstituted as the National Mark Canned and Bottled Fruit and Vegetables Trade Committee, and two new members—Mr. Sydney A. Kilner and Mr. H. Robertson—have been added by the Minister of Agriculture.

The personnel of the committee is now as follows: Sir Stanley Machin, J.P. (Chairman), Sir Edgar Jones, K.B.E., Sir William G. Lobjoit, O.B.E., J.P., Mr. G. W. Cadbury, Mr. F. Hirst, Mr. Sydney A. Kilner, Mr. H. Robertson, Mr. G. C. Salmon, Mr. Howard S. Salmon, Mr. W. P. Seabrook, Mr. S. W. Smedley, Mr. W. Sprainger.

* * *

Bakers' and Confectioners' Exhibition.

The exhibition authorities announce that they have received from the Industrial Property Department of the Board of Trade a certificate under the provisions of the Patents and Designs Acts, 1907 to 1928, certifying the exhibition as an industrial exhibition for the purposes of the Acts. This will protect exhibitors showing an invention at this exhibition, subject to certain conditions, such as giving notice of intention of exhibiting the invention and applying for a patent within six months from the date of the opening of the exhibition.

* * *

Grading of Canned Salmon.

The Canadian Government has adopted legislation rendering compulsory the inspection and grading of all Canadian canned salmon, commencing from June 1.

Several years ago it was enacted that each can of Canadian canned salmon when exported should have the word "Canada" embossed on the end. The object was to provide a definite guarantee of Canadian origin to the millions of consumers who, appreciative of the high quality of Canadian salmon, wish to make certain of obtaining it.

The new regulation further safeguards the interests of the consumer and trade, in so far that the presence of the embossed word "Canada" on the can guarantees that the contents have been inspected and graded by Government officials appointed for that purpose.

For the additional advantage of the trade in the United Kingdom and elsewhere, the new regulations also provide that the Government inspectors shall furnish a certificate of quality in all cases where they authorise the emboss-

ing of the word "Canada" alone on the can.

In the case of other canned salmon which after examination the inspectors decide is not of the highest quality, the words "Second Quality" must be stamped on the end of the can, in addition to the word "Canada."

* * *

A handsome silver challenge cup, valued at sixty guineas, has been presented to the Imperial Fruit Show by Lord Bledisloe, Governor-General of New Zealand. It is to be offered for the best exhibit of New Zealand apples entered in the spring show to be held at the Royal Horticultural Hall, Westminster, on Tuesday and Wednesday, June 7 and 8.

The John Howard Silver Challenge Cup, presented by Mrs. John Howard and Miss Howard as a memorial to the late John Howard who for many years was Agent-General in London for the province of Nova Scotia, is for the best exhibit in the British Empire Section, and may be competed for by growers, packing stations, exporters, and others, but all fruit exhibited must have been grown in the British Empire.

South African entries as well as those from New Zealand and Australia in this section shown in June will be compared with entries from England and Canada shown in the autumn at the Twelfth Imperial Fruit Show which is to be staged in the Bingley Hall, Birmingham.

* * *

Industrial Insurance.

The need for professional scrutiny of industrial insurance policies, which may contain clauses prejudicial to interests of the assured, or be imperfectly drawn, is emphasised in a folder issued by Messrs. John Jack and Son, incorporated insurance brokers, of Princes Chambers, Manchester. The difference between a properly drawn policy and one imperfectly drawn, it is urged, may entail a loss of hundreds or thousands of pounds. The firm offer to inspect and advise on the redrafting of policies so as to obtain improved cover or reduced premiums, on a "no saving, no pay" basis.

* * *

Preference on Meat?

In view of the proposals recently put ward for the imposition of tariffs on imported meat in order to give preference to supplies of Empire origin, it is interesting to recall some pointed comments recently made by Sir Edmund Vestey. Dealing with the suggestion that South American chilled beef is responsible for the low (compared with immediate post-war years) prices obtainable for home-killed meat, he points out that Irish and Canadian store cattle are really responsible for the situation. The normal price (on Smithfield—*i.e.*, wholesale) of fair average quality, home-grown beef last year was about 8d. per lb. South American chilled beef during the same period averaged 4½d. per lb., and even if a tariff were imposed to increase its price by 100 per cent. to put it on a par with home-killed, Sir Edmund suggests that the English stock-breeder would be no better off, because there simply does not exist sufficient people able to pay the price the English producer requires. In view of the great disproportion between the number of rich and poor in the country many will agree with Sir Edmund Vestey that the British farmer is doing exceedingly well to supply 57 per cent. of the beef consumption of the nation, as he is at present, in view of the fact that he has to ask prices 100 per cent. above those of imported supplies.

* * *

Invalid Foods in Australia.

On the recommendation of the Food Standards Committee, an authority constituted under the Health Act of the State of Victoria in Australia, new amendments have been made to the food and drug regulations of that state affecting foods for invalids and diabetics. The regulations provide that invalids' foods are to be composed of food substances modified, prepared, or compounded so as to possess special nutritive and assimilative properties which make them suitable for invalids. The foods must not contain any preservatives or substance incapable of being assimilated by an invalid. Foods sold or described as suitable for diabetic patients must bear a label showing the proportion and nature of the carbohydrates, fats, and proteins contained therein.

* * *

Russian Canneries to Enlarge.

A considerable enlargement of the Russian fish canning industry was ordered by the Russian Government at the end of last year. In the fiscal period 1931 to 1933 no less than 36 factories ashore and 23 floating factories for fish canning are to be constructed and taken into operation. The total output of the new plants, working with double shifts, is planned to amount to 327,000,000 1-lb. cans. In the year 1933 the total production of 2,400,000,000 1-lb. cans of preserves is to include 600,000,000 cans of fish. The new plants are to be erected chiefly in such localities from which the export of fresh or frozen fish is very difficult or impossible and in localities where the fish have hitherto not been handled for industrial use. The Kaspi Basin is to be equipped with 8 plants ashore and 16 floating factories. The fishing grounds on the Pacific Ocean (Far East) are to have 14 factories on the Amur, along the coast and in Kamchatka, as well as 7 floating shrimp canning plants. Five factories are to be erected in Northern Russia, 3 on Lake Aral, 2 on Lake Valchasch in Siberia, and 4 in Eastern Siberia. All plants are to be equipped with modern machinery and refrigerating rooms. As far as possible all machinery is to be built in Russia. For this purpose 9 further machine building plants have been turned over to the special trust for the construction of foodstuffs machinery.

* * *

Ecuadorian Import Duties on Foodstuffs.

Customs Circular 183, issued by the Ecuadorian Director General of Customs on December 23, 1931, announced the promulgation of the increased duties on a range of foodstuffs effective December 11, 1931, under the decree of November 27, 1931. The old rate is given in parenthesis.

Canned vegetables, not otherwise specified, in containers other than those of tin, glass, or pottery, 0·40 (0·25) sucres per gross kilo, 3·6 (2·3) cents per pound; tomato sauce and pulp, 0·45 (0·30) sucres per gross kilo, 4·1 (2·7) cents per pound.

Prepared soups, 0·60 (0·30) sucres per legal kilo, 5·4 (2·7) cents per pound; canned vegetables, not otherwise specified, in containers of metal, glass, or pottery, 0·70 to 0·50 sucres per legal kilo, 6·4. (4·5) cents per pound.

Other products on which duties have been increased include salt fish, fruit, canned or fresh, jellies and marmalades.

* * *

Production of Australian Raisins and Currants.

According to the Australian Dried Fruit Export Control Board, this year's raisin production is estimated at 60,480 short tons, and currants at 21,280 tons. There is no carryover in Australia or abroad. Following the exceptionally large crops in the Victoria dried grape districts in 1929 and 1930 the yield in 1931 was much lighter, being 60,440,000 pounds against 107,520,000 pounds and 106,400,000 pounds respectively for the previous two years.

The prices obtained to date, however, together with the "exchange benefit," have much more than compensated for the reduction in yield, and the actual cash returns to the growers should greatly exceed those of the two mentioned years. The recent reciprocal trade treaty made with Canada is considered locally as giving an impetus to the dried fruit trade with that Dominion. It is stated locally that Australia hopes to secure a portion of the trade in dried fruits which formerly went to the United States. The quantity of dried fruit exported to Canada during the past year exceeded 20,160,000 pounds, compared with 1,739,240 pounds exported five years ago.

* * *

Canners' Exhibition.

The twelfth Annual Imperial Fruit Show and Canners' Allied Trades' Exhibition will be held in the Bingley Hall, Birmingham, from October 21 to 29 of this year.

INFORMATION and ADVICE

ON CURING COD ROE—ICE FLAKES—SAUCE MAKING—TABLE JELLIES—BISCUIT PACKING—POTTED MEATS—SODIUM GLUTAMATE—LEMONADE POWDER—RASPBERRY CANNING

Bursting of Sausages.

650. *We should be glad to know the principal reasons for the bursting of sausages when they are cooked.* (Ireland.)

This may be due to one or more of several causes:

(1) The casing may be stuffed too tightly, so that on expansion of the meat during cooking the casing is unable to withstand the strain.

(2) If the filling of the casing is not properly carried out, resulting in air being trapped in the meat, this air expands during cooking and bursts the casing. In order to safeguard against expansion of air, sausages are generally punctured with a fork or needle before cooking.

(3) Some ingredients swell so much during cooking, especially the cereal fillers, that the skin is strained to bursting point.

(4) Raising the cooking temperature too suddenly is also liable to result in a burst.

(5) It should be remembered that a sausage skin is coagulated by cooking, with the result that it becomes less elastic.

651. *Kindly supply us with names of spice millers.* (Ireland.)

These were furnished.

652. *We shall be glad to know of a recipe for canned plums and something about the process of manufacture.* (Norway.)

Particulars will be found on page 119 of the new edition of the *Food Industries Manual*.

653. *Can you give any information about a rat poison which sets up a plague among rats and is said to have been invented by Pasteur?* (Berks.)

We have discussed the matter with a chemist who has worked on a certain preparation of this nature and have put him in touch with the enquirer.

654. *We notice in your April issue that you answered an enquiry for machines for peeling pickling onions. We should be glad to have the names of the makers.* (London.)

These names were supplied.

655. *I was interested, on looking through the May issue of your journal, to note that you had an enquiry (No. 617) for a machine for forming curly rolls and scrolls from butter. Can you favour me with the same information?* (Surrey.)

This was furnished.

656. *With reference to enquiry No. 604, page 154 of your May issue, we have noted that someone has asked for a machine for peeling onions and that you have supplied names. We should esteem it a favour if you could also supply us with names and addresses of firms making machines for peeling onions.* (London.)

This was done.

657. *Please supply us, if possible, with names of firms offering automatic filling machines for lard compound. Also names of makers of greaseproof cartons and tubs.* (London.)

This information was furnished.

658. *We have an enquiry for machinery suitable for packing cashew nuts in vacuum tins. If you can kindly supply the names and addresses of suitable firms which we might approach we shall be grateful.* (London.)

This was done.

Coproco.

659. *What is Coproco? Has it any relation to glucose? Please give any information as to its use.* (Bournemouth.)

Coproco is the term applied to crystallised dextrose. The corresponding term in America is Cerelose. Glucose, on the other hand, is a mixture of maltose, dextrine, dextrose, etc. Considerable experience is required in the successful application of crystallised dextrose to the preparation of icing and fondants, chiefly because it is prone to delayed crystallisation. It will hold up to a surprising extent without crystallisation in a supersaturated condition. There are, of course, several ways of overcoming these difficulties.

660. *Would you mind giving us your reply to enquiry No. 604 regarding a machine for peeling onions? We have tried a few foreign machines, but these will not do the work properly.* (Yorkshire.)

This information was furnished.

661. *Kindly advise me of the names of manufacturers of either hand or power machines suitable for breaking Brazil nut kernels into small pieces similar in size to the broken walnuts used for topping cakes or sundaes.* (Yorkshire.)

An ordinary mincing machine is not satisfactory for the purpose owing to the oiliness of the nuts. Probably the type of machine used for nibbing almonds would prove suitable. Suggestions as to likely firms were made.

662. *We shall be glad to have particulars of the preparation of a tomato catsup.* (Norway.)

Some particulars were furnished. This subject will be dealt with fully in a future article.

Curing of Cod Roe.

663. *We should be much obliged if you could give us some information as to the best method of curing and smoking of cod roe.* (London.)

The following summary is one of a Norwegian method used a few years ago. It is possible that certain modifications have been made since then.

Briefly, the process consists in taking the whole ovaries of the cod and salting them in barrels. These ovaries must be salted whole without injuring or breaking the enveloping membrane, but they must not be salted too much; the right point is reached when an orange-red colour is obtained.

The salted ovaries are removed from the barrels and washed several times in fresh water. They are then hung or placed on wire trays in the open air, but protected from excessive sunshine. After they have dried for about twenty-four hours,

they are placed on rods or wire trays and cold-smoked for two or three days or until they go dark brown in colour.

After smoking, the enveloping membrane or skin of the ovaries is removed and the roes packed in good barrels, which are then closed and placed in a cool place for a month or six weeks.

At the end of that period the roes begin to ferment somewhat, and this may be detected by the swelling of the barrel. As soon as fermentation has begun a sufficient quantity of salt should be added to the roe to prevent the product from spoiling.

As a result of fermentation a slightly acid flavour and taste, resembling that of fermenting beer or wine, is imparted to the roe, and this fermentation must be stopped by adding salt at a definite point, which has to be ascertained by experience. The salt employed for this purpose must be of the best quality.

If the roe appears to dry a little, a good leaf oil is added to moisten the product.

After the roe has been thoroughly mixed with salt it is put into glass bottles and securely sealed.

664. *Please give me the names of a few makers of wire-strapping tools for wiring (not hooping) packing cases, and also the names of makers of the wire.* (Wales.)

A selection of names was given.

665. *Will you kindly forward us the names and addresses of firms manufacturing complete oil hydrogenation plants?* (Liverpool.)

Suitable recommendations were made.

666. *Kindly supply names of English firms making machines for peeling pickling onions and for peeling and slicing boiled beetroots.* (Yorkshire.)

Names supplied.

Lemonade Powder.

667. *Please furnish names of manufacturers of machines for making and packing lemon powder cubes, and also a recipe for lemon powder.* (Glasgow.)

The required names were given. As regards lemonade powder, the following recipes may be of assistance in indicating the lines on which to proceed in building up a formula:

Lemonade Crystals.

56 lb. B. castor sugar.
2½ lb. citric acid.
8 oz. oil of lemon.
6 oz. of a 5 per cent. solution of tartrazine in water.

Rub the colour and lemon oil into a few pounds of the sugar, which should then be thoroughly mixed with the remainder of the sugar and the citric acid. The whole should then be rubbed through a coarse sieve to break up lumps and disperse the colour and flavour throughout the mass. To avoid the mass becoming sticky it is advisable to let it stand in the open room for a few hours—over night for preference—before packing. A freer-running product is said to be obtained if 15 to 25 per cent. of the sugar is replaced with cerelose.

Lemonade Powder.

56 lb. sugar.
2½ lb. citric or tartaric acid.
3 drams of terpeneless lemon.
2 oz. of 10 per cent. solution of colour.
6 oz. of effervescing mixture.

668. *I shall be much obliged if you can give me the name of the suppliers of Nulomoline.* (Oxford.)

Fredk. Boehm, Ltd., London.

669. *We shall be obliged if you can supply us with the names of firms from whom we could obtain precipitated chalk in quantities of a ton or more at a time. It is essential for this product to be of a high degree of purity and especially important that it should contain no impurities likely to exert an inhibiting effect upon a fermentation.* (England.)

Suggestions were made.

Raspberries for Canning.

670. *I require information on the most suitable types of raspberries, especially Scottish raspberries, for canning.* (Scotland.)

The Campden Research Station has done some work on the canning of raspberries (see *The Canners' Bulletin*, No. 3—"Varieties of Fruits Suitable for Canning," by Hirst and Adam). There is, however, nothing in this about Scottish raspberries. We would advise you to communicate with East Malling Research Station; Long Ashton Agricultural and Horticultural Research Station; Seed Testing and Plant Registration Station (Scotland); Campden Research Station.

671. *Kindly give the names of firms who make machines for opening cartons.* (Yorkshire.)

Suggestions made.

672. *We should be glad to have the names of houses selling frozen egg yolks for lemon curd making.* (Huddersfield.)

These were supplied.

673. *We require the name of the textbook asked for by enquiry No. 350, September, 1931.* (London.)

This was given.

Sauce Manufacture.

674. *We should be much obliged if you would supply recipes for thick and thin brown sauces.* (Lancashire.)

A suitable source of guidance in this work was indicated. We have recipes for these, but there is not much point in giving them unless accompanied by full directions. The enquirer should endeavour to get acquainted with the principles underlying sauce manufacture, and we recommend him to study the article on this subject which will be published shortly in FOOD MANUFACTURE.

675. *We require general information and a selection of recipes for the manufacture of chutneys.* (Wales.)

The same remarks apply here also. We shall go into this subject fully in a later issue of FOOD MANUFACTURE. Meanwhile, the enquirer is advised to digest the account given in Bulletin No. 21, Ministry of Agriculture and Fisheries.

676. *Is there any sale for banana flour in this country? Kindly give information on this product.* (London.)

See the account given on another page of the present issue.

We have from time to time had enquiries about the uses, etc., of banana flour, but although this flour appears at first sight to offer possibilities as an ingredient of fancy breads, cakes, biscuits, etc., the experience of those who have attempted its exploitation has been disappointing. One firm in London writes us: "We went very fully into the possibilities of working up a demand for banana flour, with biscuit manufacturers, vegetarian restaurants, and others, but we found that the small amount of interest that existed a few years ago has completely died out."

The "Pitman" Health Food Co., of Birmingham, who publish a small book on fresh and dried bananas and banana flour, write: "For twenty years we endeavoured to make a trade for banana flour and productions made from same, but we gave it up as a bad job some years ago, having come to the conclusion that the public did not want it and did not consider it was good value."

The small book, referred to above, gives a number of recipes for using banana flour; we notice banana bread, banana pudding, banana biscuits, and so on. It is recommended to mix banana flour with wheat flour in equal proportions, or one-third of the former and two-thirds of the latter. Any ordinary recipe for making bread or cakes may be used, the two flours being simply mixed together.

677. *In a German publication I have read that the English canning industry is taking an enormous interest in the canning of liquid eggs. I should like to have more information on this point.* (Serbia.)

We do not see how this product could compete with the Chinese imports; however, perhaps one of our readers would give his views on this question.

Ice Flakes.

678. *In the February issue of* FOOD MANUFACTURE, *on page 43, mention is made of ice flakes. We should like to have more particulars.* (India.)

A paper on "Flak Ice" was presented by Crosby Field at the nineteenth Annual Meeting of the American Institute of Refrigeration held at Washington, D.C., on May 2, 1930, and the account was published in *Ice and Refrigeration*, for September, 1930. There was also an account by C. F. Belshaw in *Refrigerating Engineering*, Vol. 16, No. 3, page 67, on the superiority of broken or cracked ice over block ice. The point that Crosby Field makes is that ice manufacturers have not taken full advantage of the natural superiority of ice due to its large "latent cold" (latent power of heat abstraction), and for this purpose it is necessary to have very large surfaces, which are best obtained in the form of large flakes or small sheets of ice. He claims that until the advent of Flak Ice no economical method of obtaining ice in this form was possible. There are many different types of machines used in the production of ice flakes; the one described by Field is the "Type B.R.C. Flak Ice Machine." Essentially it consists of a brine cooled metal cylinder rotating half-immersed in water. A device is provided for cracking and peeling the film of ice.

679. *We should be glad to know whether you can give us the names of any manufacturers of machines for stoning cherries.* (London.)

This was done.

680. *We wonder if you would be kind enough to let us know of any manufacturers of small emulsifying machines.* (Cheshire.)

Names were supplied.

681. *Kindly ask the manufacturers of "Tornado" cleansing agent to send us a trial sample with quotations.* (Ireland.)

This was done.

682. *Will you please be good enough to tell us the manufacturers of Cas-caphane caps for jam jars?* (Middlesex.)

Messrs. Cascelloid, Ltd.

Feeding Stuffs.

683. *What are the regulations concerning the presence of phosphoric acid and calcium phosphate in foodstuffs?* (Somerset.)

According to the Fertilisers and Feeding Stuffs Act, 1926-28, the following statement is required to be made in the case of the articles quoted:

Article.	*Statutory Statement.*
Feeding bone flour, or any other bone product for feeding purposes.	Amounts of phosphoric acid and albuminoids (protein) respectively.
Feeding meat and bone meal or any other product of meat (including whale meat) and bone for feeding purposes.	Amounts of oil, albuminoids (protein), and phosphoric acid respectively.
Fish meal, white fish meal, or other product obtained by drying and grinding or otherwise treating fish or fish waste.	Amounts of albuminoids (protein), phosphoric acid, oil, and salt respectively.

A copy of the Act should be consulted. Reference may also be made to "Feeding Stuffs," by A. S. Carlos.

684. *Is there any book dealing with the preparation of Drum Dried Fodder's Yeast from molasses?* (Canada.)

The enquiry is not clear. Feeding stuffs are made from both molasses and spent yeast. Any competent firm of drying engineers could design a plant for drying purposes if they have a sample of the material and particulars of output, etc. The book by Carlos mentioned above deals with feeding stuffs of the type required.

685. *Could you give us the name of a firm able to supply powdered coffee (not ground coffee)?* (Glasgow.)

Suggestions made.

686. *Could you give us an idea of the type of plant used in the manufacture of vermicelli and macaroni?* (London.)

An account of this was given in last month's issue.

687. *We shall be glad if you will put us in touch with direct importers or makers in this country of meat skewers.* (Liverpool.)

This was done.

688. *Please supply information or references to books on the manufacture of pickles, sauces, chutneys, etc., on a commercial scale.* (South Africa.)

There is no satisfactory book beyond Campbell's—and that deals with American practice. As previously noted, articles have appeared and are to be published in FOOD MANUFACTURE.

689. *We would be glad to have names of the makers of macaroni machinery.* (New Zealand.)

The makers appear to be confined to Italy. See article in last month's issue of this journal.

690. *We wish to have your suggestions as to the cause of the blackening of the inside of a tin for holding meat products. (Particulars of the circumstances were given.)* (London.)

We went into the matter and communicated our views.

691. *Please supply names of manufacturers of "Waterstof Superoxide 30 per cent."* (London.)

There appears to be some error in spelling. Names of possible suppliers were given.

692. *Can you give me one or two formulæ for making lemon cheese on a large scale?* (Lancashire.)

Reference should be made to information published in past issues of FOOD MANUFACTURE—*e.g.*, May and August, 1931.

Table Jellies.

693. *Can you give me any information concerning the use of acetic acid in table jellies? Also how to prevent mould?* (Manchester.)

Acetic acid may be used in table jellies, and for this purpose 8 oz. to each 7 lb. of gelatine of a 30 per cent. solution of acetic acid is sometimes the proportion employed. This should be added with the essence.

The growth of mould depends to a large extent on the sugar or sugar and glucose content, and also on the amount of water taken up by the gelatine. Gelatine should never be soaked in wooden containers unless they have been washed well with boiling water; also, the water should be boiled and allowed to stand until cold before soaking the gelatine in it. It is obvious that all the usual precautions should be taken to avoid contamination.

Vacuum Packing.

694. *We shall be glad if you can give us any information about the preserving of fruits in vacua, without being sterilised.* (Reading.)

We do not see how this could possibly be accomplished successfully, as the absence of air does not prevent bacterial

spoilage or enzyme action taking place, and, moreover, one would get the moisture evaporating from the fruits and occupying the evacuated space as water vapour, and the same applies to the air originally imprisoned within the tissue of the fruits.

You will realise that the mere absence of air does not destroy bacteria, and this can only be done practically by heat sterilisation.

It is an advantage to pack certain products such as dried milk, sugar confectionery, nuts and nut products, patent foods, coffee, and so on, in vacua without heat sterilisation in order to reduce the risk of spoilage by moulds (which must have oxygen), to retard rancidity, and to keep out moisture. This is a big subject in itself, and an article is being prepared by us for publication in FOOD MANUFACTURE.

695. *We should be glad to have your answer to enquiry No. 556, concerning the makers of butter packing machinery. Have you any knowledge of the sources of cultures suitable for milk souring for margarine manufacture?* (Yorkshire.)

The National Collection of Type Cultures, Lister Institute, London, issues cultures for scientific investigation purposes. They can, however, supply cultures of *B. bulgaricus* and *B. acidophilus*, which cause active lactic fermentation of milk, but the Lister Institute does not issue them with any expressed or implied statement as to their suitability in any commercial process.

The best commercial source for milk souring cultures was given. These are sold as Lactic Ferment Starter.

696. *Please inform us where we can obtain information regarding the regulations for packing biscuits by weight. We are packing and invoicing biscuits in ½-lb. packets. It occasionally, but not often, happens that a packet is 2 oz. light owing to the large size of the biscuit. Can we protect ourselves from any action by the Inspector of Weights and Measures by omitting any reference to the weight on the label and by invoicing as ½ lb. nominal?* (England.)

According to the Sale of Food Weights and Measures Act —"A person shall not in selling any article of food by weight, measure, or number, deliver or cause to be delivered to the purchaser a less weight, measure, or number, as the case may be, than is purported to be sold."

From this it appears that if you are describing your package as being of a certain weight, this weight must be maintained.

We suggest that you endeavour to reduce the maximum possible loss to not more than 1 oz. per ½ lb., and then if you do this you might be able to take advantage of another section of the Act which lays it down that the authorities shall have regard to the average weight of a reasonable number of packages, and so disregard any exceptional variation of a single one. It is also a defence to show that the deficiency is due to unavoidable evaporation.

Accordingly, we suggest that you endeavour, by making your packages slightly overweight when first packed, to reduce the loss to not more than 1 oz., and to get in touch with your local Inspector of Weights and Measures and come to an understanding with him.

Horseradish Cream.

697. *Kindly supply recipes for horseradish cream.* (Wales.)

These are usually prepared from fresh or dried horseradish, unsweetened condensed milk, vinegar, mustard, spices, etc. The chief point is to manipulate the process so as to avoid spoilage as a result of chemical changes in certain constituents of the horseradish by the action of moisture.

698. *We should be obliged if you could let us have the names of firms who manufacture dish-washing machines for hotel use.* (London.)

These were supplied.

699. *I am very much obliged for your letter dated February 15 written in answer to my various enquiries, and am pleased to tell you that the firms you gave my name to for paper seals have sent me samples, from which I am making a choice.*

I am now asking you to help me in the matter of printed and coloured wrapper labels for tinned goods, both jams and marmalades, fruits in syrup, and various meats. I require something bright and attractive, capable of covering the whole circumference of the tins, ready gummed at one end. Please put me in touch with firms supplying the above and ask them to forward samples at once. I am enclosing three samples to show the sizes of labels required to cover my present range of tins. I am using these only temporarily, being unable to obtain anything in the way of an attractive commercial label in this country. (Tanganyika.)

This was done.

700. *Please send us full particulars for the preparation and packing of beetroot in glass jars.* (Yorkshire.)

The enquirer was referred to the particulars given in the *Food Industries Manual*.

Sterilisation of Potted Meats.

701. *We have a small ham cooker in which temperatures from 50 to 200° F. can be obtained. Could this be used for retorting potted ham?* (Worcestershire.)

It is not possible to sterilise potted ham in your cooker with any satisfactory results.

Potted meats must be filled cold into the pots right up to the brim and then sterilised at 230° to 240° F. for a sufficient period to effect heat penetration uniformly throughout the pack. For this purpose you would require a retort, and you could at quite a small cost obtain a small-sized one usually used for experimental purposes.

702. *In a recent number of* FOOD MANUFACTURE *we noticed an article concerning the wrapping of crustless cheese in various shapes. You would greatly oblige us by quoting the names of manufacturers who make wrapping machinery for this purpose.* (Holland.)

Names were given.

Sodium Glutamate.

703. *Can you inform us where supplies of acid sodium glutamate are available, if possible in Australia?* (Australia.)

This information was furnished.

704. *We notice in your January issue that a British company proposes to start the manufacture of sodium glutamate. Would you be kind enough to put us in touch with this firm?* (New Zealand.)

This was done.

705. *Do you know of any firm making a machine for polishing split peas? I have been trying for some time to find one.* (Canada.)

Suggestions made.

706. *We have been receiving your journal for about a year and have found it very interesting and useful.*

We are wondering whether we could seek your assistance in the matter of supplying a formula for a paste. We need the paste for use in labelling tins, and we desire it to be one that will keep and at the same time one that will be inexpensive. If you are able to favour us with this information we will be much obliged. (Australia.)

We have previously dealt with this subject as regards the preparation of sodium silicate solutions. We put the enquirer in touch with the necessary information.

707. *Wanted, name and address of the Victoria Vegetable Paring Machine.* (London.)

New Companies

BRITISH CONTINENTAL AND AFRICAN TRADING COMPANY, LIMITED. (263092.) 13a, Welford Road, Leicester. To carry on the bus. of importers, exporters, and mnfrs. of and dlrs. in textile fabrics, yarn mchts., mnfrs. of and dlrs. in flour, meal, and food products, etc. Nom. Cap.: £2,000 in £1 shares.

S. WATTS (GROCER), LIMITED. (263039.) To take over the bus. of grocers, etc., cd. on at 55, Ayres Road, Brooks Bar, Manchester, as W. T. Bax and Sons. Nom. Cap.: £250 in £1 shares.

W. T. BAX AND SONS (CHORLTON), LIMITED. (263043.) To take over the bus. of grocers, etc., cd. on at 350, Barlow Moor Road, Chorlton-cum-Hardy, Manchester, as W. T. Bax and Sons. Nom. Cap.: £250 in £1 shares.

J. W. ATKINS, LIMITED. (263032.) Co-operative Chambers, Carts Lane, Leicester. To carry on the bus. of fruiterers, greengrocers, etc. Nom. Cap.: £500 in £1 shares.

DENNY'S (LONDON), LIMITED. (262466.) 2, Park Lane Parade, High Road, Wembley, Middlesex. To carry on the bus. of mnfg., export, wholesale and retail confectioners, etc. Nom. Cap.: £500 in £1 shares.

OLOL, LIMITED. (263004.) Greenwich House, 10-13, Newgate Street, E.C. 1. To carry on the bus. of mnfrs. of and dlrs. in jams, marmalades, pickles, etc. Nom. Cap.: £200 in £1 shares.

ARTHUR W. SMITH (YORK), LIMITED. (262982.) To carry on the bus. of importers and exporters of, agents for, and dlrs. in oil cakes, feed cakes, corn, cattle food, etc. Nom. Cap.: £5,000 in £1 shares.

BRITISH AND LITHUANIAN TRADING COMPANY, LIMITED. (263113.) To carry on the bus. of importers, exporters, and mnfrs. of and dlrs. in farm and dairy produce, provisions, etc. Nom. Cap.: £100 in £1 shares.

WORKMAN BROTHERS (BRISTOL), LIMITED. (264978.) To carry on the bus. of millers, corn mchts., etc. Nom. Cap.: £50,000 in £1 shares (15,000 pref. and 35,000 ord.).

C. HAWKINS AND COMPANY, LIMITED. (264946.) To take over the bus. of bakery and oil-firing engineers and oven builders carried on at Hylton Road, Worcester. Nom. Cap.: £10,000 in £1 shares (4,000 pref. and 6,000 ord.).

E. MILLETT AND SON, LIMITED. (265013.) To take over the bus. of confectioners and tobacconists cd. on at 13a, Sheffield Road, Barnsley, as E. Millett and Son. Nom. Cap.: £1,600 in £1 shares.

BRITISH PRODUCE FOODS, LIMITED. (265031.) To carry on the bus. of dairymen, bakers, grocers, etc. Nom. Cap.: £100 in 2s. 6d. shares.

BRITISH PROVISIONS, LIMITED. (265032.) To carry on the bus. of dairymen, bakers, grocers, etc. Nom. Cap.: £100 in 2s. 6d. shares.

MID-SUSSEX CANNING AND PRESERVING COMPANY, LIMITED. (265020.) To carry on the bus. of fruit, potato, and vegetable growers, preservers of fruit and vegetables, etc. Nom. Cap.: £2,500 in £1 shares.

MENU, LIMITED. (265246.) 4, South Place, Moorgate, E.C. 2. To carry on the bus. of pie makers, bakers, etc. Nom. Cap.: £1,000 in £1 shares.

LIDBETTER'S KINGSWAY STORES, LIMITED. (264963.) To carry on the bus. of wholesale and retail grocers, tea dlrs., Italian warehousemen, etc. Nom. Cap.: £1,000 in £1 shares.

BENACRE FARMERS, LIMITED. (265257.) To take over the bus. cd. on at the Beach Farm, Benacre, Suffolk, with shops, etc., at 156 and 160, London Road, Lowestoft, 83 and 166, High Street, Gorleston-on-Sea, and 15, Royal Arcade, Gt. Yarmouth, as the Farmers' Direct Supply. Nom. Cap.: £2,000 in 1,000 pref. and 900 prefd. ord. shares of £1 and 1,000 defd. ord. shares of 2s.

PRODUCE CLEARING, LIMITED. (265263.) To carry on the bus. of produce brokers, etc. Nom. Cap.: £1,000 in £1 shares.

BEVO, LIMITED. (265056.) 27, Church Street, Barnoldswick, Yorks. To carry on the bus. of shredded beef suet and sausage mnfrs., etc. Nom. Cap.: £100 in £1 shares.

ENGLAND'S BREAKFAST FOOD, LIMITED. (265093.) To carry on the bus. of mnfrs. of and dlrs. in patent and prepared food, etc. Nom. Cap.: £4,000 in £1 shares.

JOHN CLEE AND COMPANY, LIMITED. (265284.) Chesterfield House, 98, Great Tower Street, E.C. To take over the bus. cd. on at Great Tower Street, E.C., as John Clee and Co., and all or any of the assets and liabilities connected therewith, and to carry on the bus. of produce importers, agents and dlrs. in dried, bottled, canned, and green fruits and vegetables, etc. Nom. Cap.: £2,000 in £1 shares.

ARRANDALE, LIMITED. (265223.) Imperial Buildings, Market Place, Loughborough, Leicester. To purchase and sell fruit, etc. Nom. Cap.: £400 in £1 shares.

SMETHWICK MALT FLOUR COMPANY, LIMITED. (265145.) To carry on the bus. of mnfrs. of and dlrs. in malt flour, malt bread, and malt extracts, etc. Nom. Cap.: £500 in £1 shares.

EDWARD JAGGERS, LIMITED. (264479.) Norman Walks, Norman Road, Ilford Lane, Ilford, Essex. To take over the bus. of a mnfg. confectioner cd. on by E. Jaggers at 30, Margery Park Road, E. 7. Nom. Cap.: £1,000 in £1 shares.

EAST ANGLIAN PRESERVING COMPANY, LIMITED. (264512.) To carry on the bus. of mnfrs. and packers of, agents for, and dlrs. in food products, patent foods, etc. Nom. Cap.: £100 in £1 shares.

W. BAILEY, LIMITED. (264606.) 456, North Row, Covent Garden, W.C. To carry on the bus. of pea, potato, and genl. produce mchts., etc. Nom. Cap.: £2,000 in £1 shares.

UPWELL (WISBECH) CANNERY COMPANY, LIMITED. (264605.) Lloyds Bank Chambers, Wisbech, Cambs. To carry on the bus. of canners of fruit, vegetables, etc. Nom. Cap.: £1,000 in £1 shares.

The above-mentioned particulars of new companies recently registered have been extracted from the daily register of Messrs. Jordan and Sons, Ltd., company registration agents, Chancery Lane, W.C. 2.

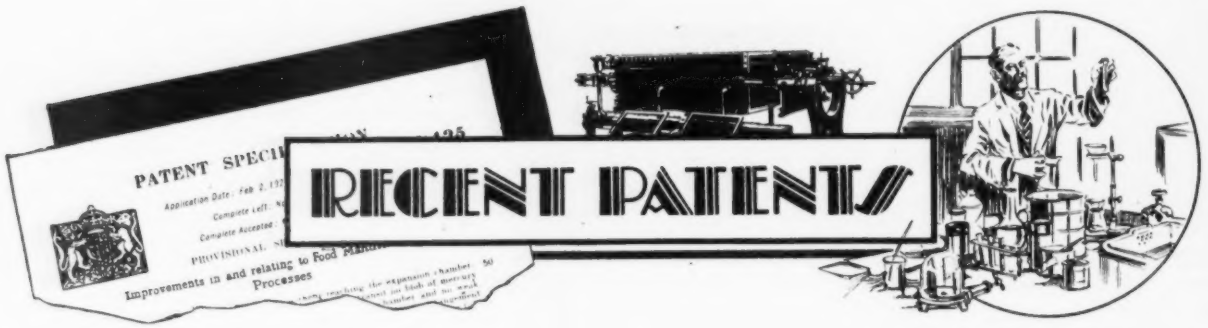
Meat Pastes and Candied Peel

Articles on the Manufacture of Meat Pastes and of Candied Peel will be published next month.

The Metal Box Co. Issue

Of the recent issue by the Metal Box Co., Ltd., of £600,000 5½ per cent. First Mortgage Debenture Stock and 200,000 7 per cent. Cumulative Preference shares of £1 each, the underwriters were, according to a contemporary, left with 46 per cent. of the Debenture Stock and 57 per cent. of the Preference shares.

FOOD MANUFACTURE is sent to any address in the World for 10s. per annum. Send your subscription now to LEONARD HILL, LTD., Thanet House, 231-2, Strand, London, W.C. 2.



These particulars of New Patents of interest to readers have been selected from the Official Journal of Patents, and are published by permission of the Controller of H.M. Stationery Office, and the Official Journal of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Latest Patent Applications

11668. HARBER, L. S., and BAKER PERKINS, and POINTON, J. E.: Manufacture of bread. April 22.

11233. HAZELL, J. S.: Coffee and cocoa. April 19.

11311. REAVELL, J. A.: Apparatus for cooking, etc., foodstuffs. April 20.

10750. TRAUBE, I.: Refining sugar, etc. April 14.

9646. TRANIN, S.: Food product. April 4.

Specifications Published

371,336. TALLGREN, H.: Method for the preservation of articles of food and other organic substances.

370,939. POTTER, R. S., and WOODCOCK, A. B.: Jelly for use by confectioners, pastrycooks, and others, and the method of preparing the same

371,193. MEIER, G., and BATTERMANN, H.: Butter-moulding machines

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2., at the uniform price of 1s. each.

Abstracts Published

Group abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per group volume, or in bound volumes price 25s. each.

364,940. **Cocoa preparations.** TRIGGS, W. W., 57, Lincoln's Inn Fields, London (Schokoladenfabrik Mauxion, Saalfeld, Saale, Germany).

A concentrated foodstuff is formed by breaking down cocoa powder and aqueous sugar solution with acid, such as formic acid. The amount of acid used lies within the limits of 0·15 normal. In the example 30 parts of sugar are dissolved in 40 parts of water, and 20 parts of oil-less cocoa powder added. This is acidified by fruit acid, lactic acid, or other organic or mineral acids and heated to about boiling. The heating is continued till the protein substances are disintegrated to a state favourable for digestion.

364,957. **Cocoa preparations.** TRIGGS, W. W., 57, Lincoln's Inn Fields, London (Schokoladenfabrik Mauxion, Saalfeld, Saale, Germany).

The product obtained by heating cocoa powder and sugar solution with small quantities of acid, described in the parent specification, is modified by adding a paste or suspension of dry milk and homogenising the mixture.

365,086. **Yeast.** BERTEL, R., 12, Weimarerstrasse, and SCHUSSLER, O., 7, Passauerplatz, both in Vienna.

A dry yeast adapted for use in baking and in manufacture of wine, etc., is made by incorporating separated yeast with readily soluble salts of lactic acid, and, if desired, phosphoric acid in the solid state, and then drying the mixture. Thus, separated yeast is incorporated with calcium lactate or a mixture of calcium lactate and primary calcium phosphate or lactophosphate of calcium, and the mixture is dried by current of air at 30 to 35° C. The resulting dry yeast may also be employed for therapeutical preparations.

Solid Carbon Dioxide

"NEW" is a word capable of varying interpretations, for instance, it has recently been used in connection with solid carbon dioxide, which has been referred to as the "new" refrigerant. Actually, of course, solid CO_2 has been known, especially to brewery engineers, for many years, and it also found a limited application in surgery for sterilisation purposes. What is new about it is its recent application to a wide variety of commercial uses, in which it can often replace the less convenient, more bulky, and less efficient water ice.

It first became commercially available (as distinct from production in privately owned plants) when it was placed on the market under the name "Cardice" by the Carbon Dioxide Co., Ltd., of Liverpool, and it is also now being produced in a factory in the London area by an associated concern, Solvent Products, Ltd., which has taken over distribution of Cardice for Southern England. Due to its peculiar physical properties, however, it is very desirable that solid carbon dioxide should be used in specially designed equipment. For instance, in the case of ice-cream cabinets, the Carbon Dioxide Co., Ltd. has designed several types which are available at exceedingly low prices, and which are so designed that a small quantity of Cardice, probably about 2 lb. for a 2-gal. cabinet, will keep the ice-cream in perfect condition throughout a long summer day. A special point is that the *application* of the temperature within the cabinets is controllable, and thus the consistency of the ice-cream may be varied as desired. The production and storage of ice-cream, of course, are only two of the many purposes to which solid CO_2 can be applied. Its exceptionally low temperature and property of "subliming" as a dry, clean, odourless, and tasteless gas (ordinary carbon dioxide as used in aerated waters) render it very valuable and convenient in a number of processes connected with the food industry.